***Prevalence of cord blood parasitaemia in maternal fever and its outcome in the health of newborns.***

**Dissertation submitted for**

**M.D.DEGREE EXAMINATION**
**BRANCH VII – PAEDIATRIC MEDICINE**

**THE TAMILNADU Dr.M.G.R. MEDICAL UNIVERSITY**

**CHENNAI**

**APRIL 2016**

**INSTITUTE OF CHILD HEALTH AND**

**HOSPITAL FOR CHILDREN**

**MADRAS MEDICAL COLLEGE,CHENNAI**

# CERTIFICATE

This is to certify that dissertation entitled "***Prevalence of cord blood parasitaemia in maternal fever and its outcome in the health of newborns***" submitted by Dr. CHEWANG DORJEE BHUTIA to the Faculty of Paediatrics , The Tamilnadu Dr. M.G.R. Medical University ,Chennai in partial fulfilment of the requirement for the award of M.D. Degree (Paediatrics) is a bonafide research work carried out by her under direct supervision and guidance.

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Professor of Paediatrics,
Unit Chief &Research Guide,
Institute of Child Health.

# DECLARATION

I CHEWANG DORJEE BHUTIA solemnly declare that the dissertation titled " ***Prevalence of cord blood parasitaemia in maternal fever and its outcome in the health of newborns*** " has been prepared by me. This is submitted to the Tamilnadu Dr . M.G.R. Medical University , Chennai in partial fulfillment of the rules and regulations for the M.D degree examination in Paediatrics.

DATE : CHEWANG DORJEE BHUTIA

PLACE :

# ACKNOWLEDGEMENT

It is my immense pleasure that I express my heartfelt gratitude, admiration and sincere thanks to PROF . DR. S. SUNDARI, M.D.DCH., Professor and head of the Department of Paediatrics for her guidance and support during the study as Head of the Department.

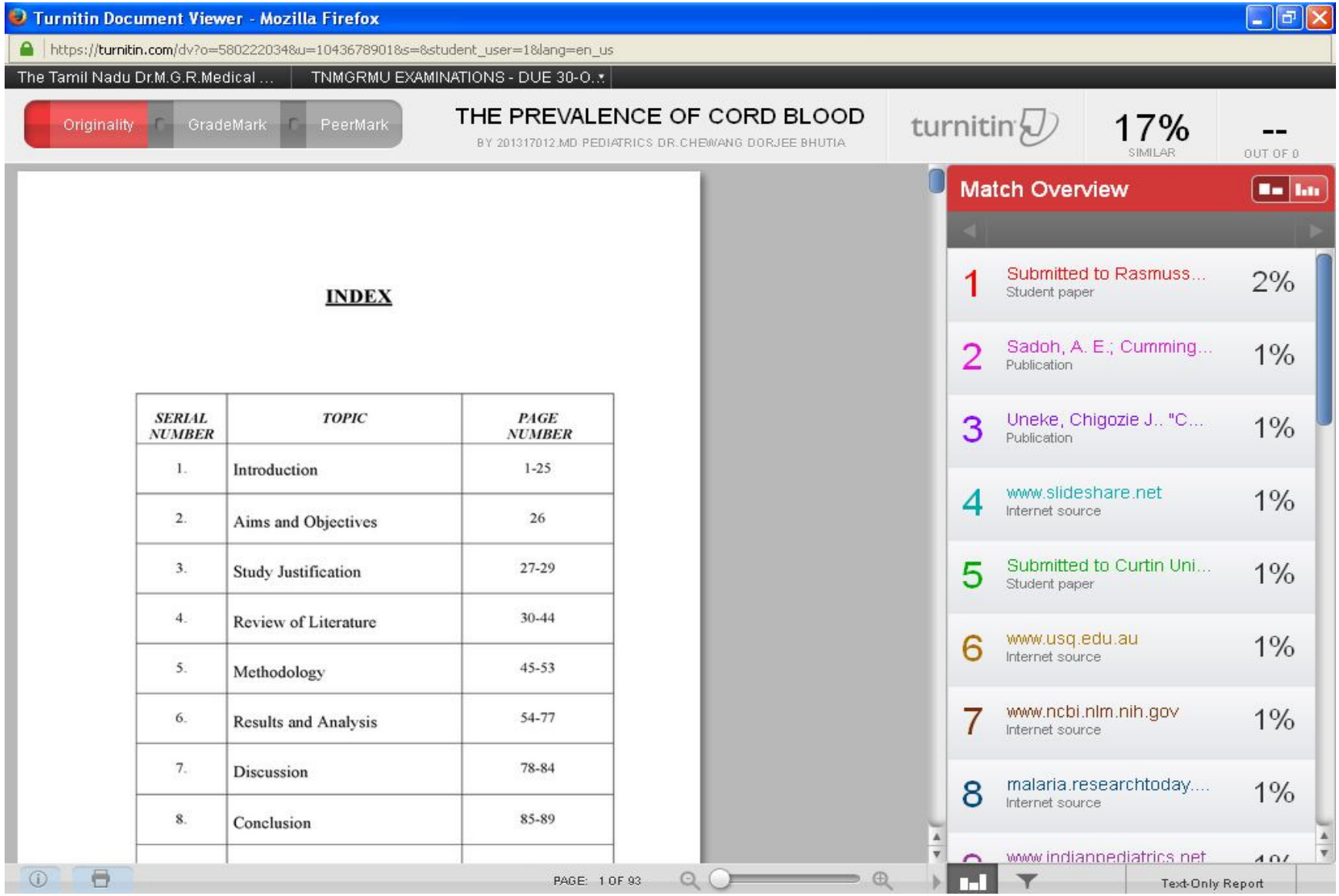
I express my sincere thanks and gratitude to my chief PROF. DR. K.VANITHA, MD . DCH.,for her support, guidance and constant encouragement throughout the study.

I am greatly indebted to my teacher DR. I. SASIREKHA, Chief , Maternal health & newborn , IOG for her supervision, encouragement and guidance while doing the study.

I would like to thank my ASST PROF Dr. S. Srinivasan, MD, Dr. Sudhakar,Dr.Ravishankar and Dr.Gomathy for their valuable suggestions and support. I also thank all the members of the dissertation committee for their valuable suggestions. I also express my gratitude to all my fellow postgraduates for their kind cooperation in carrying out this study and for the critical analysis.

I thank the DEAN PROF. DR. VIMALA, Madras Medical College, Chennai for permitting me to perform the study.

I thank all the parents and the children who have ungrudgingly lent themselves to undergo this study and without them, this study would not have seen the light of the day.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INDEX
SERIAL NUMBER
TOPIC
PAGE NUMBER
1. Introduction 1-25
2. Aims and Objectives 26
3. Study Justification 27-29
4. Review of Literature 30-44
5. Methodology 45-53
6. Results and Analysis 54-77
7. Discussion 78-84
8. Conclusion 85-89
PAGE: 1 OF 93
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INDEX

# INDEX

# Abstract


## Aim :

The aim of the is to study the prevalence of cord blood parasitaemia in maternal fever and its outcome in the health of the newborn.

## Method :

The study was conducted during the months of February to September , 2015 at Institute of Gynaecology, Chennai. The study was done among 100 newly delivered babies whose mothers had history of fever during the antenatal period. One ml of cord blood was collected from the umbilical vein and stored in EDTA tubes. Thin and thick smears of cord blood were prepared and examined by an experienced personnel for cord blood parasitaemia. They were then followed for organomely , fever , jaundice, anaemia & birth weight monitored. Repeat smear was taken from babies showing any of the symptoms.

## Results :

No sample tested positive for cord blood parasitaemia. Maternal malaria was reported from 6 mothers. (6%) Three babies were of LBW and two were preterms among mothers with maternal parasitaemia. A total of 28 babies showed systemic manifestations among smear negative mothers. Among these none of them tested positive for cord blood parasitaemia repeat smear.

## Conclusion :

The study has shown no prevalence of cord blood parasitaemia. The study recommends to conduct more studies on neonatal outcomes of maternal malaria with different diagnostic modalities in Indian setup.

# INTRODUCTION

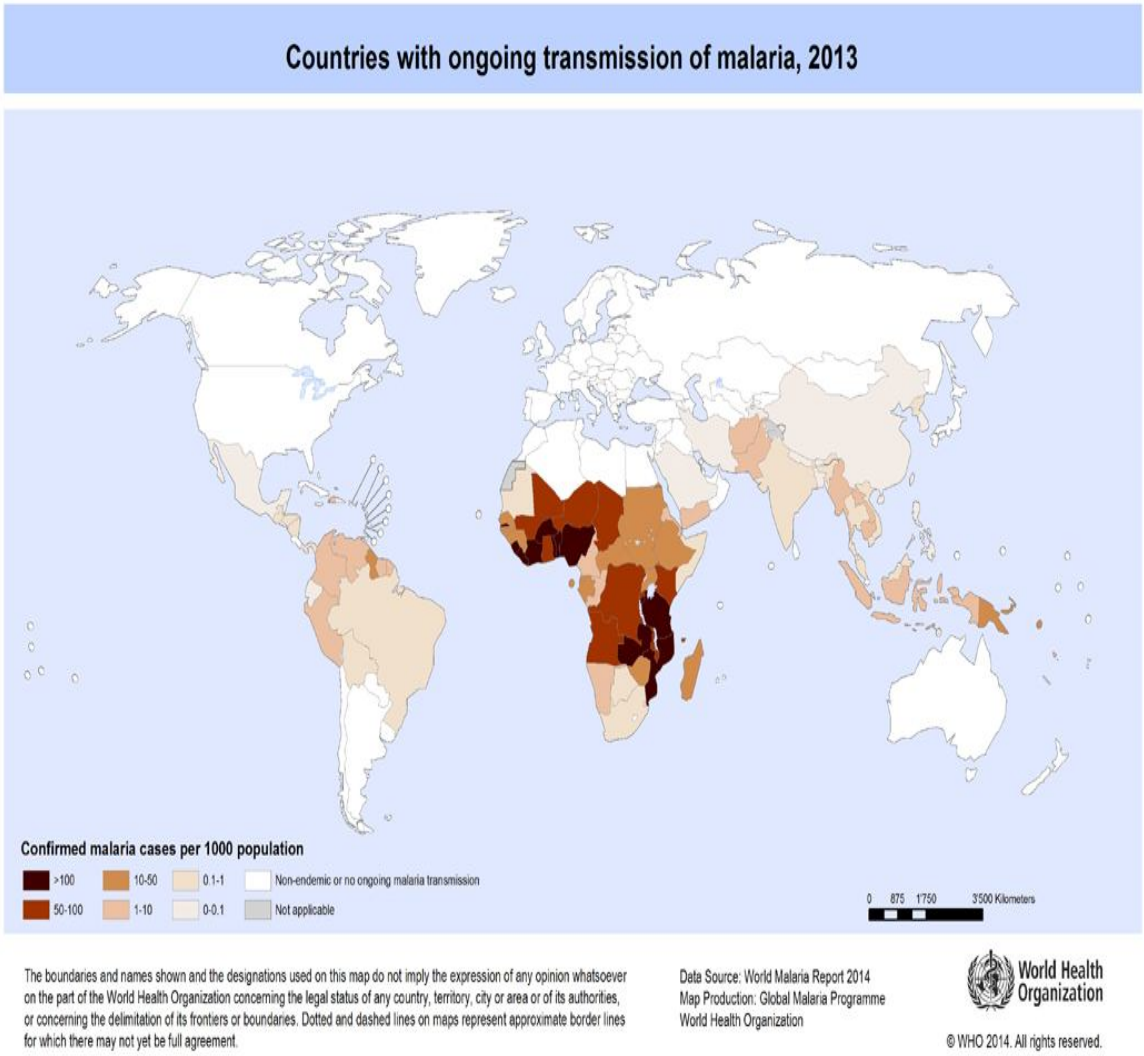
A worldwide infectious disease shrouding the multitude of countries inhabiting the tropics and sub-tropics, Malaria poses as an acute and complicated health setback. Related to lack of development, poverty, insufficient resources and general unawareness, this protozoal disease continues to play an undeniable role in the staggering rate of the overall infectious disease-related mortality and morbidity in the world. The countries particularly affected are Africa, the Mediterranean States, S-E Asia, and some areas of South America. [(1)]

Malaria affects all the 6 major regions of the world, putting more than 3 billion individuals spanning over almost 100 countries and territories at a threat of being infected with the parasite and developing the disease (as shown in Map 1). Almost 1.2 billion people are at a higher risk (more than 1 in 1000 likelihood of contracting the disease in a year).

The most recent estimates of the year 2013 reported 198 million malaria cases worldwide. The disease has resulted in 584,000 deaths the same year. Since the year 2000, a decline in the mortality rate of forty-seven percent and in the incidence rate of thirty percent has been seen.

Africa has reported the highest affliction of malaria. Ninety percent of all malarial deaths are known to occur in Africa alone and children under 5 years account for seventy-eight percent of all deaths. (2)

Deaths in childhood is mostly due to cerebral malaria and anaemia.




**Map 1: Map showing worldwide distribution of malaria**

**(adapted from WHO 2014)**

Around twenty-seven percent of the total population in India live in areas of high transmission (more than 1 case per 1000 population). Fifty-eight percent of the population live in areas of low transmission (1 – 2 case per 1000 population). Ninety-two percent of malaria cases in India occur in the states of Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Maharashtra, Gujarat, Northeast, Rajasthan and West Bengal.

The disease is characterized by paroxysms of fever with chills, rigor, fatigue, anaemia and hepatosplenomegaly. Classical malaria consists of three distinct stages i.e. the cold stage, hot stage and the sweating stage. These events are followed by an afebrile phase bringing great relief to the patient. The clinical manifestations may vary from mild to severe and complicated depending on the species and the person's immunity.

The disease is transmitted by the bite of an infected female *Anopheles* mosquito (Figure 1).

Malaria in humans is caused by the four distinct species of Plasmodium which include the (Figure 3):

- *Plasmodium falciparum*
- *Plasmodium vivax*
- *Plasmodium malariae*
- *Plasmodium ovale.*

Plasmodium falciparum which is known to be more dangerous than the other species, is primarily responsible for the most severe malaria cases and deaths related to it. (3)

Ninety percent of global malaria-related deaths have been known to occur in the sub-Saharan Africa regions, which has the highest burden. Plasmodium falciparum is the prime species here.

Several studies have reported that Plasmodium Vivax is the prime species affecting the regions around Southeast Asia and America. (4) It is also known to have the highest geographical distribution across the world over.

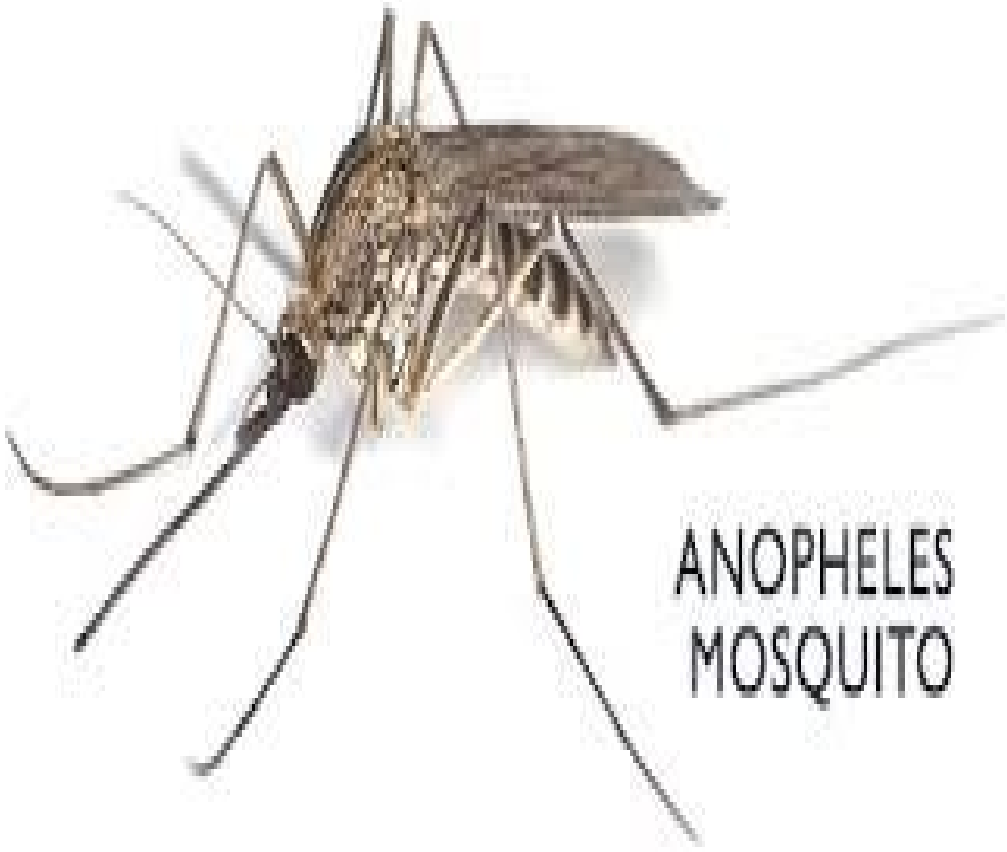



**Figure 1: Female Anopheles Mosquito**

Female Anopheles mosquitoes are the vectors for malaria. 45 species are known to exist. A minimum of 12 days is required to become infective. Their breeding habitats also vary. The breeding areas include moving water, brackish water, wells and cisterns. They are nocturnal in their habits. (5)

# LIFE CYCLE OF PLASMODIUM

Plasmodium undergoes 2 cycles of development in two different hosts – one in the human (asexual form) and the other in the mosquito (sexual form). Humans are the intermediate host where they replicate in numbers whereas the mosquito is the definite host where they undergo sexual maturation (as shown in Figure 2).

The life cycle of a plasmodium can be explained as such:

- the hepatic phase,
- the erythrocytic phase and
- the gametogeny.

## HEPATIC PHASE

The malarial parasite resides in the gut and salivary glands of an infected female mosquito. Infection is transmitted to humans when an infected mosquito bites and injects sporozoites into the human bloodstream. The sporozoites soon disappear within 60 minutes from peripheral circulation and

then invade the liver. Circumsporozoite protein (CS), the surface proteins, mediate hepatocyte invasion.

Sporozoites go through asexual reproduction and develop into schizonts over 1 – 2 weeks. Schizonts are known to contain thousands of merozoites. Number of merozoites within schizonts varies. Each *Plasmodium falciparum* sporozoite can contain up to 40,000 merozoites. There are no clinical symptoms during this phase.

## ERYTHROCYTIC CYCLE

A mature schizont ruptures releasing merozoites into circulation. Soon it attaches itself to erythrocytes. Within the RBC, it consumes Hb for energy, and then transforms itself into trophozoites. It again forms schizonts and begins another cycle of asexual reproduction, producing up to 36 merozoites per schizonts. The schizont ruptures releasing merozoites into circulation again, thereby infecting the rest of the RBCs.

The whole process of infection, multiplication, and rupture goes on and on till it is subdued by the immune system. This phase is associated with systemic manifestations.

# SPOROGONIC CYCLE

In all species of malaria, the erythrocytic forms fail to divide. They only differentiate into male and female gametocytes which are taken in by a mosquito during a blood-meal. Fertilization of gametocytes occur within the stomach of mosquitoes forming zygotes. These zygotes then develop into motile and lengthened ookinetes, which penetratethe mosquito’s mid-gut wall to develop into oocysts.

The oocysts then rupture releasing sporozoites that later reach salivary gland of the mosquitoes. This cycle can repeat again once the mosquito feeds on another human host during a blood-meal.

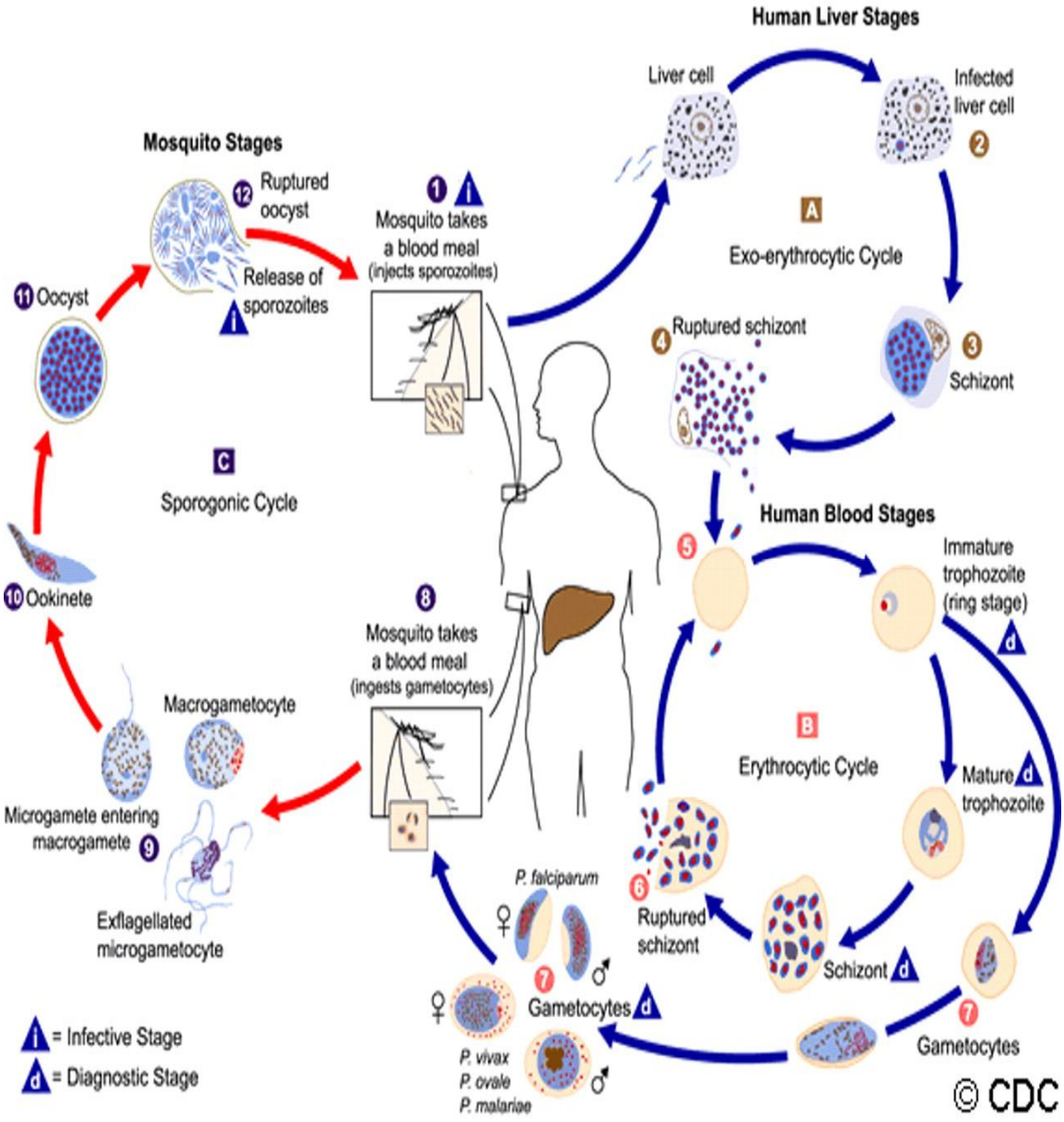



Figure 2: Life Cycle of Plasmodium Species

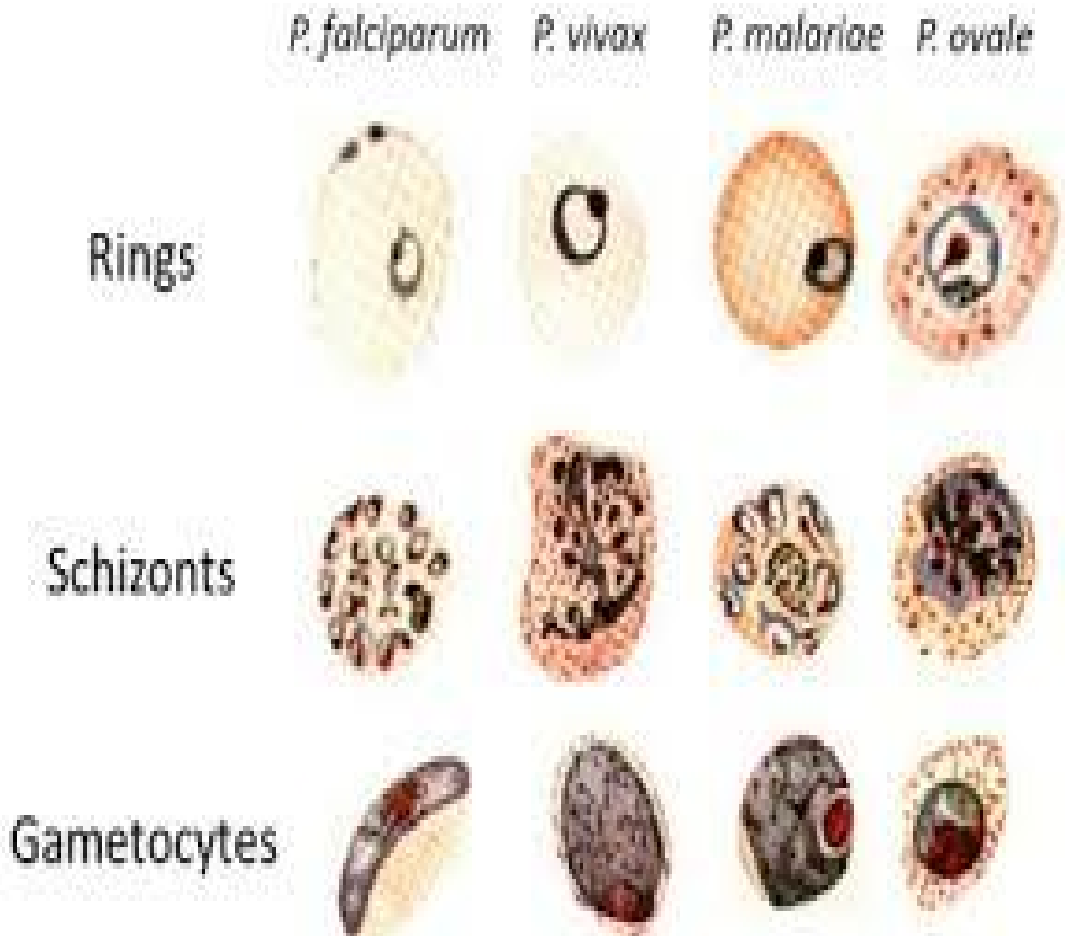



Figure 3: Plasmodium Species

Most malarial deaths have been reported among infants and young children. The population groups that are most at risk to malaria are the children and the pregnant women.(6)Pregnant women are more vulnerable to its adverse effects because of their reduced natural immunity.(7)

Malaria continues to pose as a public health problem as its consequences in pregnancy are grave for both the mother as well as the child. The adverse impact on new-borns start before the child is born.

**"Congenital malaria denotes the occurrence of asexual forms of malarial parasites in the peripheral blood film of a neonate within the 1st seven days of life."**

Its risk factors include

- maternal peripheral parasitaemia,
- placental parasitaemia and
- cord blood parasitaemia. [8]

Parasitaemia in the cord blood is known to have great association with peripheral parasitaemia in the neonates. A latest review of congenital malaria deemed the presence of cord blood parasitaemia to be a category of the definition of congenital malaria .[8]

# CONGENITAL MALARIA

The true incidence of congenital malaria remained a controversial issue for many years as many had reported it to be a very infrequent occurring. (9) However, in the year around 1980, a low incidence of congenital malaria had been reported from Africa. The occurrence of malarial parasite in the cord blood or the neonatal blood was determined to be insignificant. Also very less infants developed symptoms of congenital malaria.[10]

The resistance to transmission of congenital malaria is offered by:

- the placenta acting as a physical obstruction to block the infected RBCs,
- the transfer of maternal antibodies and
- high foetal Hb composition and relatively lower free $O_2$tension.

All these factors provide poor survival conditions for plasmodial growth.[11] A number of cross-sectional studies conducted on congenital malaria within the last twenty years indicated that it is not as uncommon as was initially speculated.

A close relationship between the placental parasitaemia and the cord blood parasitaemia was demonstrated, which was felt to contribute to its occurrence.

'A study from Kenya by Malhotra et al had reported that the malarial parasites recovered from the cord blood were acquired transplacentally and primis were at much higher risk for congenital infection.(11) The finding further contradicted the earlier studies of its low occurrence and supported that the placental transmission of malaria was more frequent and the placental obstruction is not very effective to restrict its transmission.'

A number of factors have been reported to influence its estimation.

These factors include:

- difference in understanding the criteria for defining congenital malaria;
- resistance of mothers to infection;
- source from where the blood samples were taken for smear examination (neonatal or cord blood);
- the experience and reliability of peripheral smear examinations by the trained medical personnel;

- the technique used for parasite detection ( Giemsa staining with smear examination or PCR). (12)

Failure to consider these factors could lead to its underestimation. Therefore, these influencing factors must be taken into consideration so as to avoid the false estimation of its prevalence. (12)

# MECHANISM OF CONGENITAL MALARIA

The mechanism involving the passage of the malarial parasite from infected mothers to their newly born infants is still not clearly understood. Possible mechanisms that could be involved include:

- organisms directly penetrating through the chorionic villi,
- untimely placental-separation, and
- the likelihood of the mother's RBCs gaining entry into the foetal circulation *in utero* or during labour.

Many features that openly effect this rate include:

- resistance of mothers to malaria infection, (13)
- severity of malaria during pregnancy, (14)
- lack of immunity among mothers, (15)
- placental parasitaemia among primi and multigravida and
- HIV infection among mothers. (16)

# CLINICAL FEATURES

The typical clinical symptoms usually occur after the first seven days of the neonate's life (but has been reported on the first day aswell). The most common clinical manifestations in most of the cases include (17)

- pyrexia,
- anaemia and
- organomegaly.

These symptoms may be observed right after birth but in some cases there might be a delay for a number of weeks or even more.

The affected new-borns may also present with (17)

- jaundice,
- regurgitation,
- loose stools,
- decreased intake of feeds and
- lethargy and cyanosis can also be seen.

There may at times be delay in the onset of symptoms in the affected new-borns. This could partly be due to the factors that may provide protection

to the new-borns initially ,especially those being delivered by women living in endemic zones. The factors could be foetal Hb , haemoglobinopathies providing resistance ,the emission of white blood cells or toxic substances derived from macrophages which cross the placenta into foetal circulation and anti-malarial therapy taken by mothers during pregnancy.[17]

Poor fetal growth, low birth weight, pre-term delivery, miscarriage, stillbirth and malnutrition during infancy have also been associated. (18)

# CONGENITAL MALARIA- DIAGNOSIS

Timely and exact identification of congenital malaria and suitable intervention is mandatory in dealing with this issue. Many cases of congenital malaria go undiagnosed due to absence of specific symptoms. (19)

Malaria is diagnosed by the examination of parasites under the microscope on Giemsa-stained blood smears (both peripheral thick and thin blood smears) (Figure 4). Microscopy is the most widely used technique in all malaria affected areas for the diagnosis.

A good clinical examination and follow up, a high index of suspicion and peripheral blood smear examination by an experienced personnel is essential for the accurate diagnosis of congenital malaria. [20]

Plasmodium antigen detection (polymerase chain reaction) of the blood and rapid diagnostic tests (Figures 5 and 6) are other alternative methods that give good results.

Histopathological examination of the placenta can also be employed. [8]

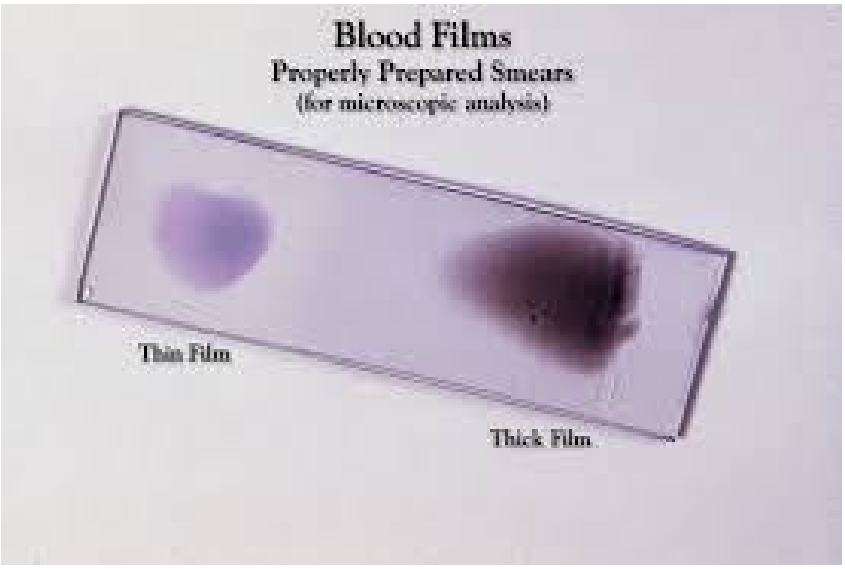



Figure 4: Thick and Thin Peripheral Smears


Figure 5: Rapid Diagnostic Kit

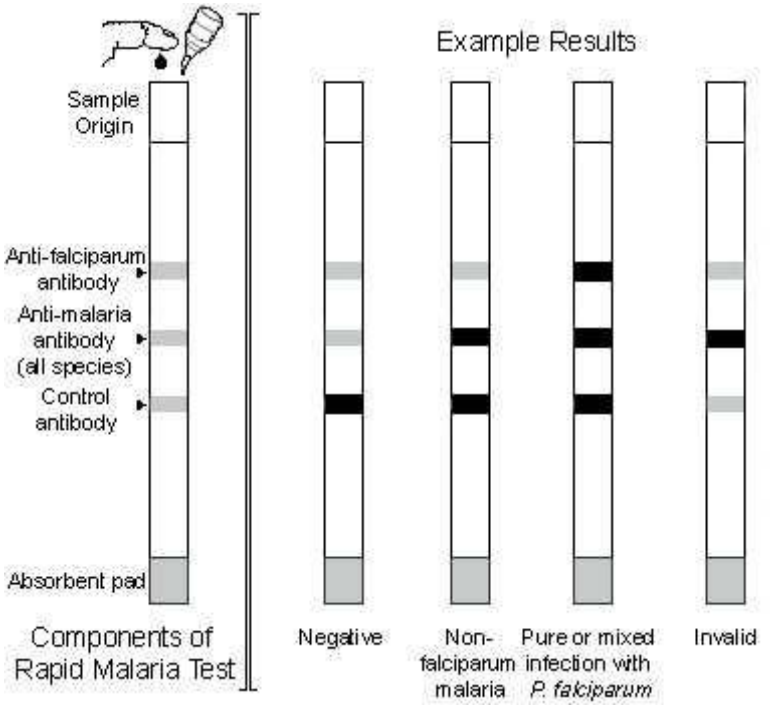



Figure 6 Rapid Diagnosis Of Malaria By $Rdt_s$ Test Kit

## What is Malaria RDT???

•A malaria RDT or "dipstick RDT detects specific antigens or protiens developed by malaria parasites
•Principle-lateral flow or immunochromatographic stick method
•Signifies presence of an antigen by colour change on adsorbing nitrocellulose strip.
•RDTs sensitive to malarial antibodies-used for screening of donated blood

# TREATMENT OF CONGENITAL MALARIA

Though a number of latest studies have given an idea about the proper and efficient management of congenital malaria, there is evidently no defined guidelines for the treatment of congenital malaria. [21]

Menendez & Mayor (2007) emphasized in their report that it would be constructive on one's part to differentiate between babies delivered to immune and non – immune mothers, and all symptomatic cases should be treated with quinine at a dosage of 10 mg/kg /8 hours orally or in same dosage in IV form till it can be administered orally. [12]

Chloroquine-resistant congenital malaria has been reported in a number of studies.

Quinine with Clindamycin was recently stated for proving useful in the treatment of Plasmodium Falciparum congenital malaria. Chloroquine was considered to be effective for the treatment of Plasmodium Vivax infection. [22]

For complicated cases one should consider intravenous quinine or intravenous artesunate.

An Indian study observed that a case of congenital malaria which showed no response to chloroquine, showed good response to artesunate. [23]

Chloroquine had been the first line of treatment for many years and the ever increasing resistance to it has prompted many to consider research on the effectiveness of other antimalarial drugs.

A study done in China, while making a comparison between the effectiveness of artesunate with that of quinine in the treatment of congenital malaria showed artesunate being superior to quinine and concluded that one can consider it as a first line drug. [24]

However , more studies are needed to further explicate the effectiveness of artesunate in the treatment of congenital malaria.

# AIMS AND OBJECTIVES

## AIM:

To study the prevalence of cord blood malarial parasitaemia in a malaria endemic zone.

## OBJECTIVES:

1. To determine the prevalence of cord blood parasitaemia in a sample of 100 pregnant women reporting with fever around the time of delivery.

2. To assess neonatal outcome in terms of parity of mother, birthweight of newborn, gestational age, systemic manifestations such as fever, jaundice, organomegaly , anaemia.

# STUDY JUSTIFICATION

- The population groups that are most at risk to malaria are children and pregnant women. [7]
- Pregnant women are vulnerable because of their reduced natural immunity. [8]
- Its consequences start before the child is born.
- Congenital malaria has been documented in malaria endemic areas for many years.
- The clinical symptoms are normally observed after the first seven days of neonatal life (though it has been observed to manifest on the first day as well ). These include fever, anaemia, jaundice, hepatosplenomegaly lethargy, poor feeding, drowsiness, irritability etc. [17]
- Poor foetal growth, low birth weight, pre-term delivery, miscarriage, stillbirth, malnutrition during infancy have been associated. [17]
- Congenital malaria is considered to be the least known manifestation of malaria. [12]

- Most of the current studies are based on cases of babies delivered by non-immune mothers. [34]

- It was assumed that children below six months of age were comparatively more guarded against malaria due to presence of mother's immunoglobulins and foetal Hb.

- Several cross-sectional studies conducted within the last twenty years showed that it is not as rare as was formerly speculated.

- Current knowledge is mostly limited to African studies.

- A study done at a tertiary centre in hyper endemic zone in Central India has reported some incidence of congenital malaria and emphasized the need to conduct more studies in the Indian setup. (7)

- In India, Chennai city has been an endemic area for malaria.

  70 percent of the malaria cases in Tamil Nadu were recorded only from Chennai.

- There is a need of considering it as differential diagnosis to avoid its adverse consequence. [25]

- So this study aims to find out the prevalence of cord blood parasitaemia & its consequences on the health of the newborn.

# REVIEW OF LITERATURE

## I. Placental and Neonatal Outcome in Maternal Malaria.

**PUBLISHED:** Indian Journal of Paediatrics

VOLUME 51

APRIL 15, 2014

**AUTHORS:**Jyoti Singh, Dharmendra Soni,

Devendra Mishra, H P Singh

AndS Bijesh

**OBJECTIVES:**

To find out the incidence of congenital malaria in a group of pregnant women in a hyper-endemic area of central India.

To determine the placental weight and parasitaemia, and to assess its outcome in terms of survival, mean hemoglobin and mean birthweight in newborns.

**STUDY DESIGN:**

Prospective observational study.

**PLACE:**

Maternity and neonatal ward of a tertiary level Hospital attached to a medical college located in Rewa , Madhya Pradesh, INDIA.

**SAMPLE SIZE:** 200

The study was done among term primis admitted in the maternity ward and their newborns.

**RESULTS:**

Out of 70 infected mothers, only 6 (2.95%) neonates had parasitaemia. Birth weight was less in the exposed group. Difference in the proportion of preterm babies , incidence of still birth and early neonatal death were not significant among the exposed and unexposed group.

**CONCLUSION:**

The study showed a low incidence of congenital malaria low in spite of high maternal parasitaemia. Need to consider more studies in the Indian setup.

## II. Epidemiology of Malaria in Pregnancy in Central India.

**PUBLISHED:** SOUTHEAST TROPICAL MEDICINE

Journal 2007

**AUTHORS:** N. Singh, M.M. Shukla and

V.P. Sharma

**STUDY DESIGN:**

Prospective observational study

**PLACE:**

The study was conducted at Government Medical College and Hospital in Jabalpur, Central India

**SAMPLE:**

The study was done among pregnant women with gestational age from 12 week's gestation up to 40 days after delivery. The study was carried out on women with a history of fever.

**RESULTS:**

365 mothers were found to be infected.

155 neonates weighed 500 g less than non-infected.

3% abortion, 3.7% stillbirths and 2% neonatal deaths were reported.

**CONCLUSION:**

The study concluded that pregnant women residing in the area have increased susceptibility to malaria infection during pregnancy and puerperium.

# III. Effects of Malaria in Pregnancy on Newborn Anthropometry

**PUBLISHED:**

Journal of Infectious Diseases in Developing Countries

2010; 4(7):448-453.

**AUTHORS:**

Catherine O. Falade, Olukemi O. Tongo, Oluwatoyin O. Ogunkunle, Adebola E. Orimadegun.

**PLACE:**

The study was conducted in secondary Health Care

Centres in Ibadan, southwestern Nigeria.

**SAMPLE:**

Study was conducted among 983women attending

antenatal clinic and their newborns.

**RESULTS:**

- Prim gravida had higher incidence of placental parasitaemia.
- Placental, maternal and combined placental and maternal malaria were 13.1%, 12.7% and 11.1% respectively.
- Mothers with parasitaemia delivered more babies with LBW and a lower mean length.

**CONCLUSION:**

Maternal parasitaemia results in symmetric foetal growth retardation.

The incidence placental parasitaemia is more among primis.

# IV. The Effect of Maternal, Umbilical Cord and Placental Malaria Parasitaemia on the birthweight of newborns from South-western Cameroon

**AUTHORS:**

Akum AE, Kuoh AJ, Minang JT et al

**AIM:**

Impact of maternal, placental and cord blood parasitaemia

on the birth weight of newborns.

**PLACE:**

Mutengene Maternity Centre, Fako Division, South West Province,

Cameroon.

**STUDY DESIGN:**

Observational cross-sectional study

**METHOD:**

770 parturient women were considered in the study .The presence of maternal, placental and cord blood parasitaemia was determined by light microscopy .Blood samples were collected between June 1999 and September 2001. The birthweights of their newborns were recorded immediately.

**RESULTS:**

Malaria parasitaemia were present in 7.8 percent, 32.8 percent and 33.7 percent cord, maternal and placental biopsies respectively.

Newborns from malaria positive cases had higher

incidence of LBW.

**CONCLUSION:**

Maternal malaria parasitaemia has a negative impact on birthweight of their newborns.

# V. Congenital Malaria among inborn babies at a tertiary centre in Lagos, Nigeria.

**PUBLISHED:** OXFORD JOURNAL 2006

**AUTHORS:** Mukhtar MY, Lesi FE, Iroha

EU, Egri-Okwaji MT, Mafe AG.

**AIM:**

To determine the incidence of congenital malaria in newborn babies and to determine the frequency of parasitaemia in their mothers and placenta.

**PLACE:**

Tertiary Centre in Lagos, Nigeria.

**STUDY DESIGN**:

Cross-sectional study.

**SAMPLE:**

The study enrolled 100 women attending ANC and their newborns.

Their placenta and the cord blood of their newborns were examined for parasitaemia.

**RESULTS:**

The incidence of congenital malaria was 16/104 (15.3%).

**CONCLUSION:**

Congenital malaria is not a rare entity.

# VI. Prevalence and Pattern of Cord Blood Malaria Parasitaemia in a general practice setting in sub-Saharan Africa.

**PUBLISHED:** Nigeria J medical, 2011 Jan - March

**AUTHORS:** Nnaji GA, Ezeagwuna DA, Olu EA.

**AIM:**

Find out the prevalence and pattern of umbilical cord blood malaria in a family practice setting in sub-Saharan Africa.

**METHODOLOGY:**

A prospective case study of pregnant women at delivery was done in a private practice setting in sub-Saharan Africa. Smears prepared from maternal peripheral blood and umbilical cord blood were examined under light microscope for malarial parasites.

**RESULT:**

Prevalence of cord blood malaria was 64.6% compared with 68.8% for maternal blood.

Primis had the highest prevalence of parasitaemia.

**CONCLUSION:**

There exists a close association between placental malaria and umbilical cord parasitaemia.

Primis are more prone to a higher prevalence of parasitaemia.

# VII. Patterns of Cord, Placental and post-delivery Maternal Malaria parasitaemia.

**AUTHORS :** Oringanje C, Meremikwu M, Ogar B, Okon A, Udoh A.

**AIM:**

To evaluate the status of malaria in pregnancy in Cross River State, Nigeria.

**METHOD:**

Maternal, placental and cord blood samples were collected and examined for malaria parasites by light microscopy.

**RESULTS:**

Out of the total 120 (19.2%), 69 (14.7%) and 62 (13.5%), respectively, had positive maternal, placental and cord blood parasitaemia.

**CONCLUSION:**

The prevalence rates of parasitaemia at delivery indicate there is a high rate of malaria transmission from mothers to their newborns.

# METHODOLOGY

## STUDY DESIGN

Observational Cross Sectional Study

## PLACE OF STUDY

Institute Of Gynaecology, CHENNAI

## TIME OF STUDY

FEBRUARY 2015 TO SEPTEMBER 2015

## SAMPLE SIZE

100

## INCLUSION CRITERIA

Newly delivered babies of mothers who were admitted with history of fever.

## EXCLUSION CRITERIA

- Mothers with known medical conditions.

  (such as cardiac diseases, pulmonary diseases, hypertension, renal diseases, HIV infection, cancer, diabetes) were not included.

- Newborns with birth asphyxia and

- Newborns with congenital malformations.

# ETHICAL ISSUES

- A written , informed consent was taken from each pregnant mother and her spouse when she got admitted in the ward.

- Approval for conducting the study was procured before initiation of the study from Departmental Ethics Committee.

- All the participants were given the choice to leave the study at any time during their hospital stay if they so wished.

# STUDY MANEUVER

The study was conducted during the months of February to September 2015 in the Maternity and Neonatal Wards of Institute of Obstetrics & Gynaecology, a tertiary health centre attached to Madras Medical College in Chennai, Tamil Nadu.

Chennai is considered to be one of the endemic areas for malaria in the southern Indian state of Tamil Nadu.

Pregnant women admitted in the Annexe labour wards were approached. Mothers with history of fever during the antenatal period were enrolled in the study. A written, informed consent was procured from each of these parturient mothers and her husband when she got admitted in the ward. The study required inclusion of all newborn babies admitted with history of maternal fever. Mothers with any known medical disorder were excluded from the study.

# SPECIMEN COLLECTION

The study involved collection of one millilitre of cord-blood from the umbilical vein at the time of delivery. Each millilitre of cord-blood was accumulated and kept in EDTA Tubes (Figure 7).

Figure 7: EDTA tubes used for Sample Collection

# LABORATORY METHODS

- Thin and thick films of cord blood were made on clean microscope slides and were then dried in the air.

- Both thin and thick smears were stained using Giemsa stain.

- The thin smears were methanol-fixed before staining.

- The slides were instantly labelled.

- The smears were viewed at X 100magnification under oil immersion objective by a trained medical personnel.

- The detection of asexual stages of the parasite on the thick films was counted as a positive diagnosis. The thin films helped to determine the species.

- A negative diagnosis was judged if no parasite could be determined after checking 500 White Blood Cells.

- Blood samples were not drawn from all the babies ( except from the ones who showed systemic manifestations and were subsequently followed up).

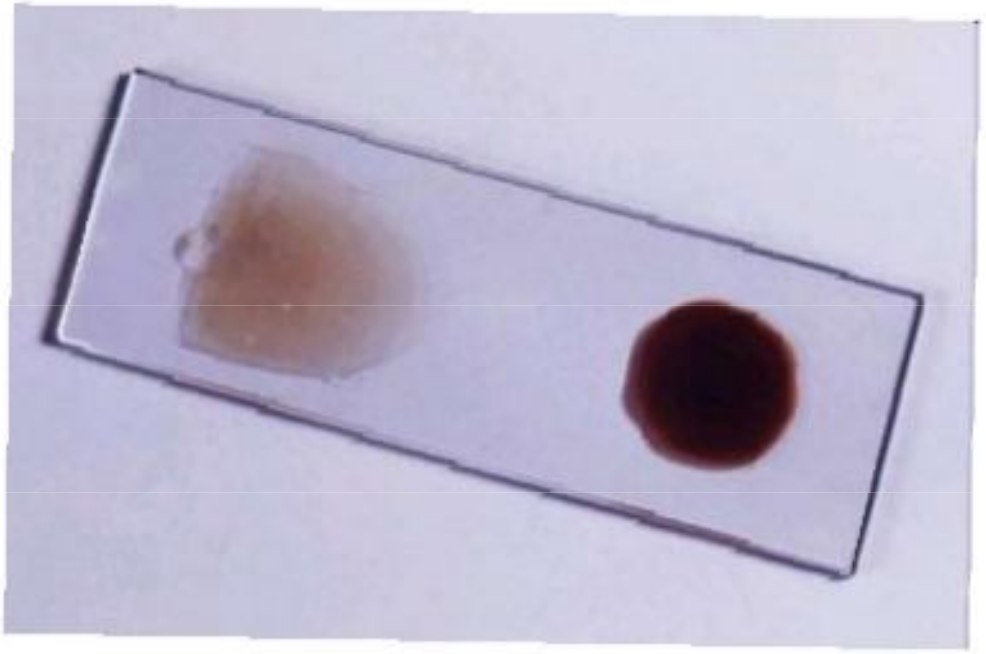


Figure 8: Thin and thick smears prepared from cord blood

# CLINICAL EVALUATION

All babies were seen and assessed.

The gestational age of the newly born babies were determined using the Ballard scoring system (through neuromuscular and physical assessment of newborn) and by the history of last menstrual period.

I : Preterm: A gestational age of less than 37 weeks

Term: A gestational age between 37 and 42 weeks

Post term: A gestational ageover 42 weeks Birth weight of each baby was recorded.

II : LBW: Birthweight less than 2.5 kg at birth was considered to be low birth weight

Normal : Birthweight between 2.5 kg and 3.5 kg at birth was considered to be normal birth weight

HBW: Birthweight more than 3.5 kg at birth was considered to be high birth weight.

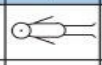
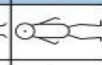
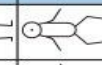
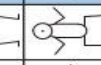
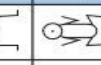
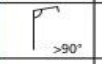
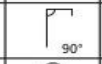
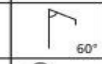
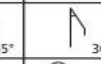
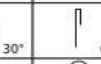
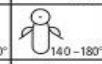
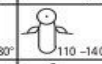
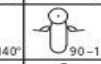
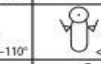
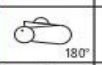
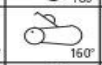
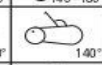
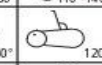
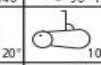
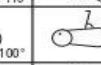
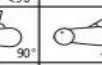
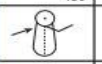
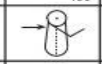
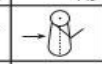
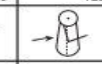
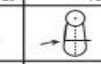
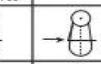
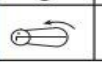
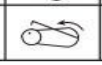
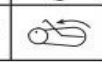
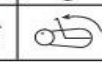
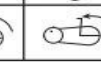
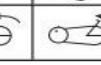
The rectal temperature of the babies was taken using a digital thermometer. Fever was considered to be present when temperature > 38 degree Celsius.

Neonates were followed up for organomegaly, jaundice, fever, anaemia and features of lethargy/poor feeding. A repeat peripheral smear examination was done to look for malarial parasites from all the babies showing any of these symptoms.

## MATURATIONAL ASSESSMENT OF GESTATIONAL AGE (New Ballard Score)

NAME _____ SEX _____
HOSPITAL NO. _____ BIRTH WEIGHT _____
RACE _____ LENGTH _____
DATE/TIME OF BIRTH _____ HEAD CIRC. _____
DATE/TIME OF EXAM _____ EXAMINER _____
AGE WHEN EXAMINED _____
APGAR SCORE: 1 MINUTE _____ 5 MINUTES _____ 10 MINUTES _____

### NEUROMUSCULAR MATURITY

| NEUROMUSCULAR MATURITY SIGN | SCORE | | | | | | | RECORD SCORE HERE |
|---|---|---|---|---|---|---|---|---|
| | -1 | 0 | 1 | 2 | 3 | 4 | 5 | |
| POSTURE |  |  |  |  |  |  | | |
| SQUARE WINDOW (Wrist) |  >90° |  90° |  60° |  45° |  30° |  0° | | |
| ARM RECOIL | |  180° |  140–180° |  110–140° |  90–110° |  <90° | | |
| POPLITEAL ANGLE |  180° |  160° |  140° |  120° |  100° |  90° |  <90° | |
| SCARF SIGN |  |  |  |  |  |  | | |
| HEEL TO EAR |  |  |  |  |  |  | | |
| | | | | | | | TOTAL NEUROMUSCULAR MATURITY SCORE | |

### PHYSICAL MATURITY

| PHYSICAL MATURITY SIGN | SCORE | | | | | | | RECORD SCORE HERE |
|---|---|---|---|---|---|---|---|---|
| | -1 | 0 | 1 | 2 | 3 | 4 | 5 | |
| SKIN | sticky friable transparent | gelatinous red translucent | smooth pink visible veins | superficial peeling & / or rash, few veins | cracking pale areas rare veins | parchment deep cracking no vessels | leathery cracked wrinkled | |
| LANUGO | none | sparse | abundant | thinning | bald areas | mostly bald | | |
| PLANTAR SURFACE | heel-toe 40–50 mm: -1 < 40 mm: -2 | >50 mm no crease | faint red marks | anterior transverse crease only | creases ant. 2/3 | creases over entire sole | | |
| BREAST | imperceptible | barely perceptible | flat areola no bud | stippled areola 1–2 mm bud | raised areola 3–4 mm bud | full areola 5–10 mm bud | | |
| EYE / EAR | lids fused loosely: -1 tightly: -2 | lids open pinna flat stays folded | sl. curved pinna; soft; slow recoil | well-curved pinna; soft but ready recoil | formed & firm instant recoil | thick cartilage ear stiff | | |
| GENITALS (Male) | scrotum flat, smooth | scrotum empty faint rugae | testes in upper canal rare rugae | testes descending few rugae | testes down good rugae | testes pendulous deep rugae | | |
| GENITALS (Female) | clitoris prominent & labia flat | prominent clitoris & small labia minora | prominent clitoris & enlarging minora | majora & minora equally prominent | majora large minora small | majora cover clitoris & minora | | |
| | | | | | | | TOTAL PHYSICAL MATURITY SCORE | |

**Reference**
Ballard JL, Khoury JC, Wedig K, et al: New Ballard Score, expanded to include extremely premature infants. J Pediatr 1991; 119:417–423. Reprinted by permission of Dr Ballard and Mosby—Year Book, Inc.

**SCORE**
Neuromuscular _____
Physical _____
Total _____

**MATURITY RATING**

| SCORE | WEEKS |
|---|---|
| -10 | 20 |
| -5 | 22 |
| 0 | 24 |
| 5 | 26 |
| 10 | 28 |
| 15 | 30 |
| 20 | 32 |
| 25 | 34 |
| 30 | 36 |
| 35 | 38 |
| 40 | 40 |
| 45 | 42 |
| 50 | 44 |

**GESTATIONAL AGE (weeks)**
By dates _____
By ultrasound _____
By exam _____

Figure 9: New Ballard score

# RESULTS AND ANALYSIS

Data was collected in a planned form and was regularly recorded and revised in a Microsoft Excel data sheet. Data was analyzed using SPSS 16.0. and OPEN epl version for statistics.

A total of 100 patients were included in the study sample. All infants with history of maternal fever who satisfied the inclusion criteria were included in the study group.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | YES | 100 | 100.0 | 100.0 | 100.0 |

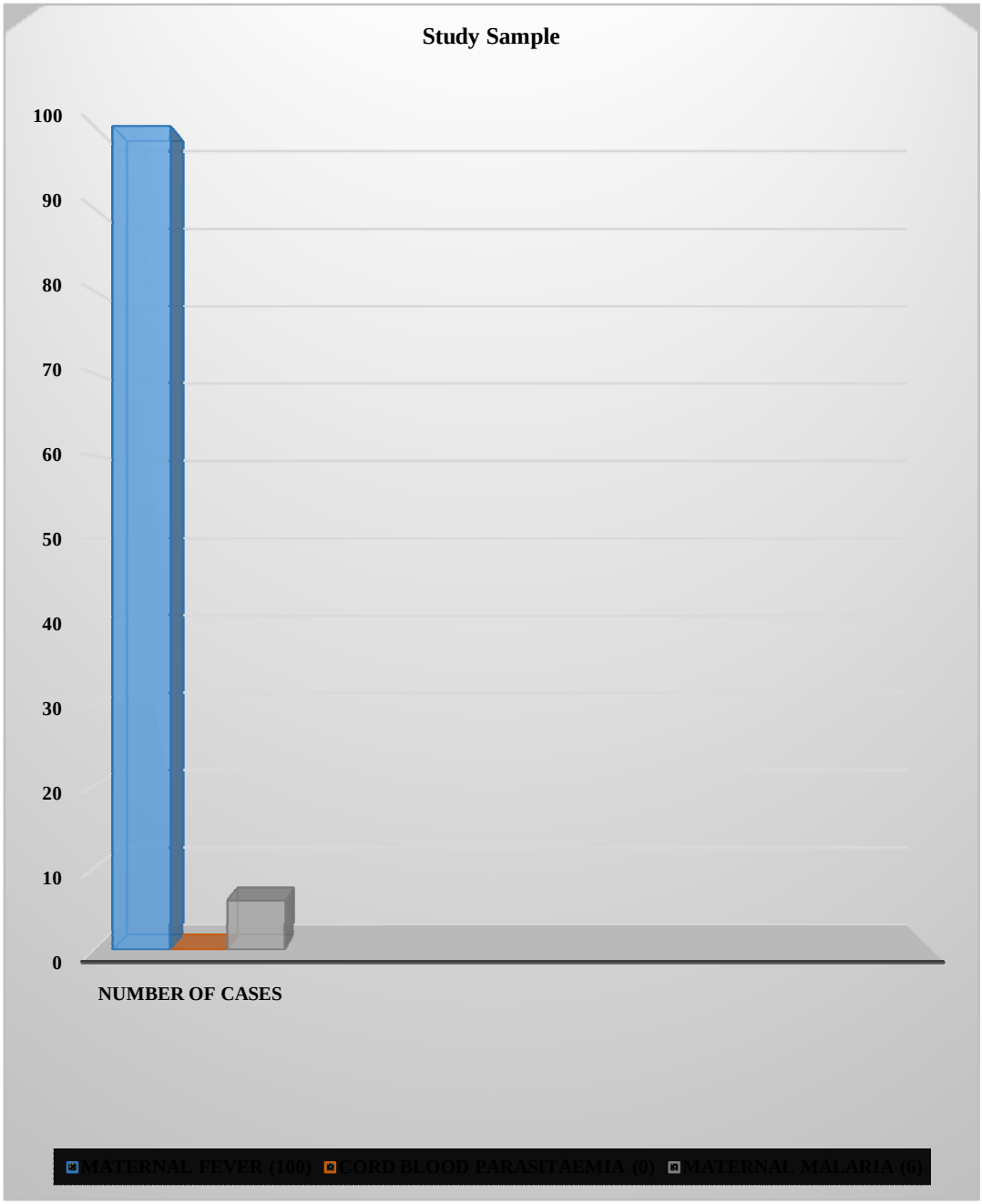
Table 1: Table for Maternal Fever

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | NEGATIVE | 100 | 100.0 | 100.0 | 100.0 |

Table 2: Table for Cord Blood Parasitaemia

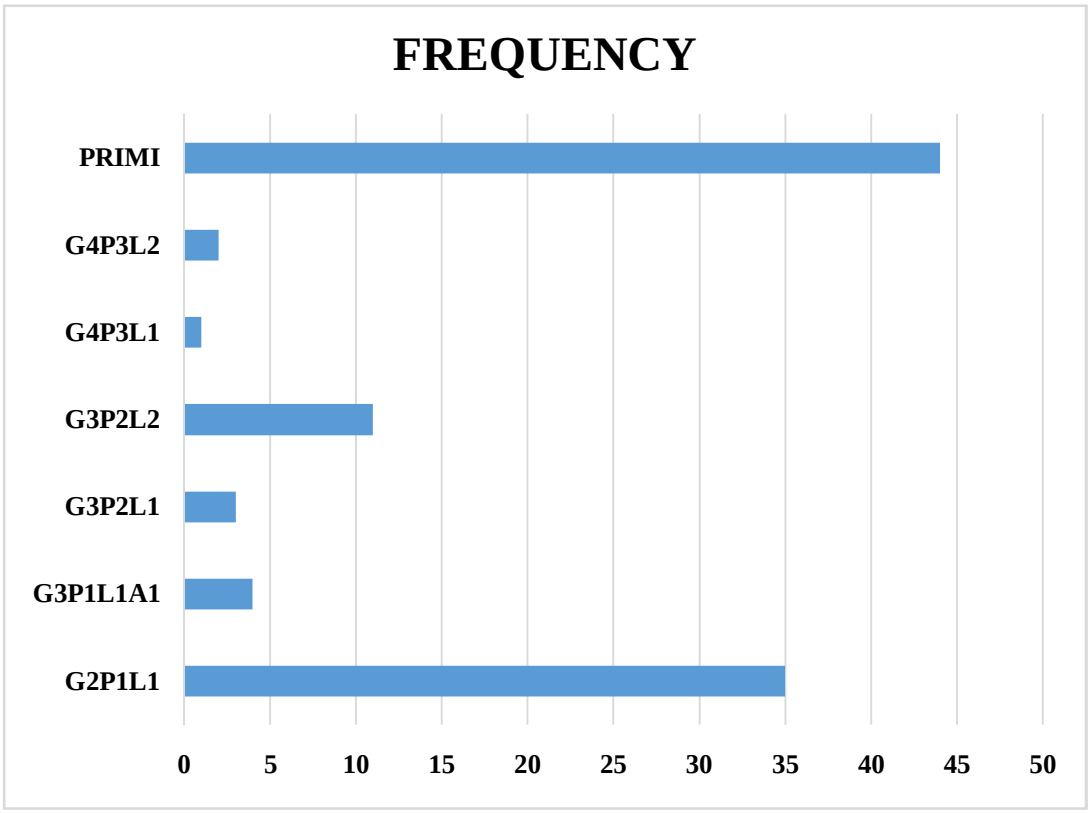
100 samples of cord blood were procured and investigated for parasitaemia.

Malarial parasites **could not be detected** among the cord blood samples examined, though six mothers had reported with malaria parasite peripheral smear positive.


Study Sample
100
90
80
70
60
50
40
30
20
10
0
NUMBER OF CASES
MATERNAL FEVER (100)
CORD BLOOD PARASITAEMIA (0)
MATERNAL MALARIA (6)

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **VALID** | G2P1L1 | 35 | 35.0 | 35.0 | 35.0 |
| | G3P1L1A1 | 4 | 4.0 | 4.0 | 39.0 |
| | G3P2L1 | 3 | 3.0 | 3.0 | 42.0 |
| | G3P2L2 | 11 | 11.0 | 11.0 | 53.0 |
| | G4P3L1 | 1 | 1.0 | 1.0 | 54.0 |
| | G4P3L2 | 2 | 2.0 | 2.0 | 56.0 |
| | PRIMI | 44 | 44.0 | 44.0 | 100.0 |
| | **TOTAL** | **100** | **100.0** | **100.0** | |

Table 3: Table for Gravida of Study Sample



Among the 100 mothers enrolled in the study sample, maximum were primigravida.

This was followed by gravida 2 para 1.

Mothers with gravid 3 were less than 20.

Among the 6 cases of maternal malaria detected, 3 were primigravida and 3 were multigravida.

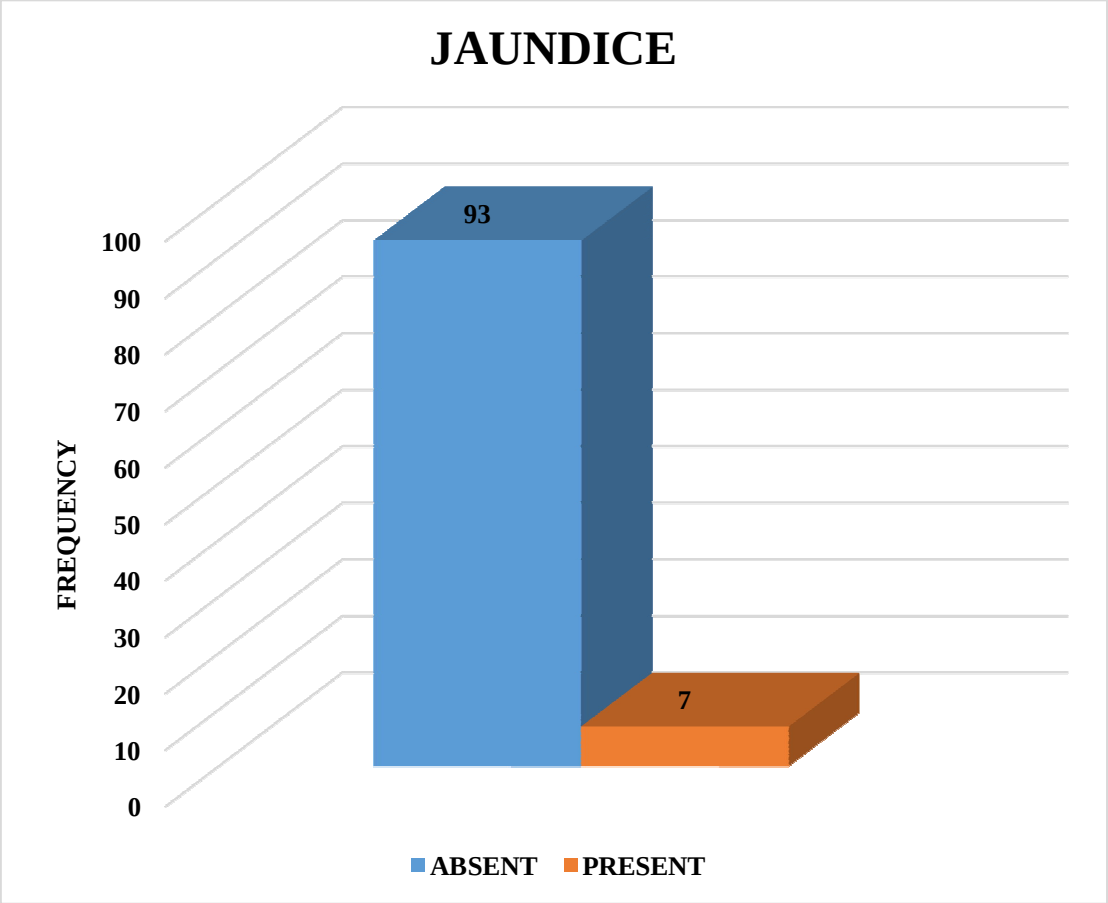
The infants were followed up for symptoms of congenital malaria.

They were examined for the presence of jaundice, fever, anaemia and organomegaly.

Gestational age and birthweight of the newborns were also taken in account.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Absent | 93 | 93.0 | 93.0 | 93.0 |
| | Present | 7 | 7.0 | 7.0 | 100.0 |
| | **Total** | **100** | **100.0** | **100.0** | |

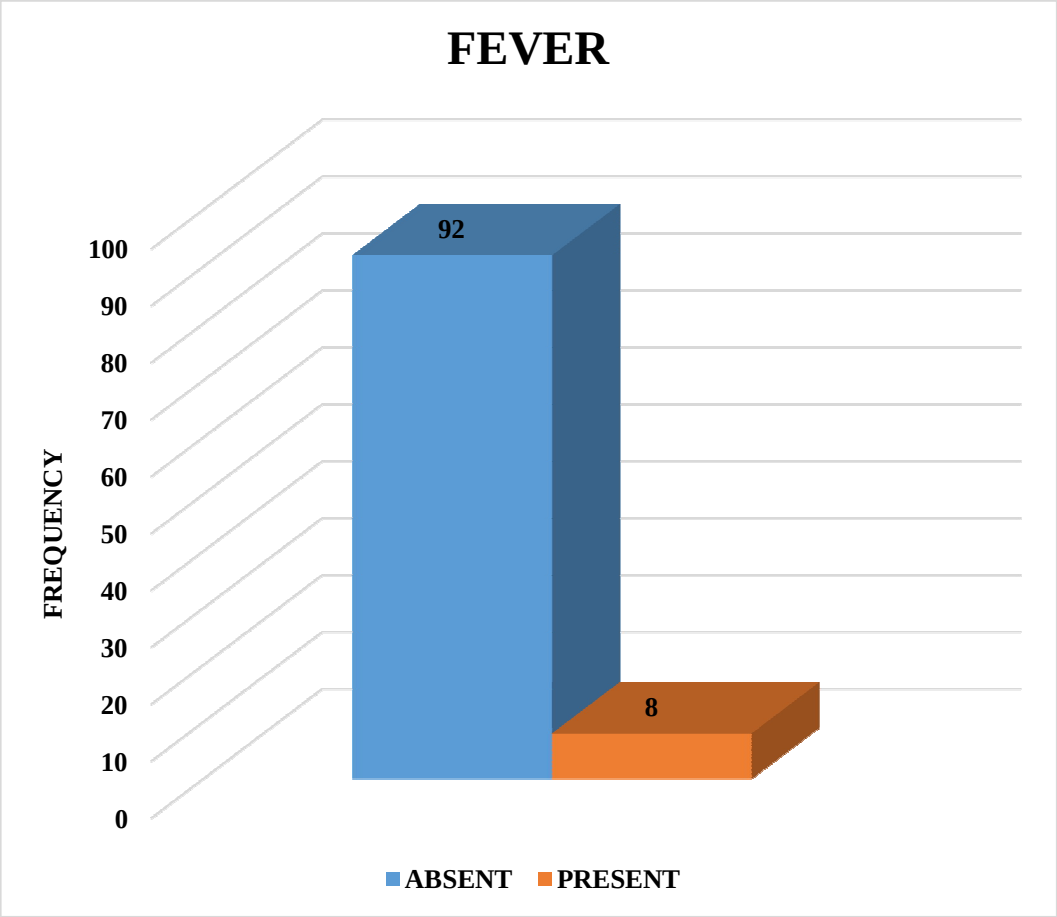
Table 4: Table for Neonatal Jaundice




Jaundice was reported from 7 out of the 100 children included in the study.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Absent | 92 | 92.0 | 92.0 | 92.0 |
| | Present | 8 | 8.0 | 8.0 | 100.00 |
| | **Total** | **100** | **100.0** | **100.0** | |

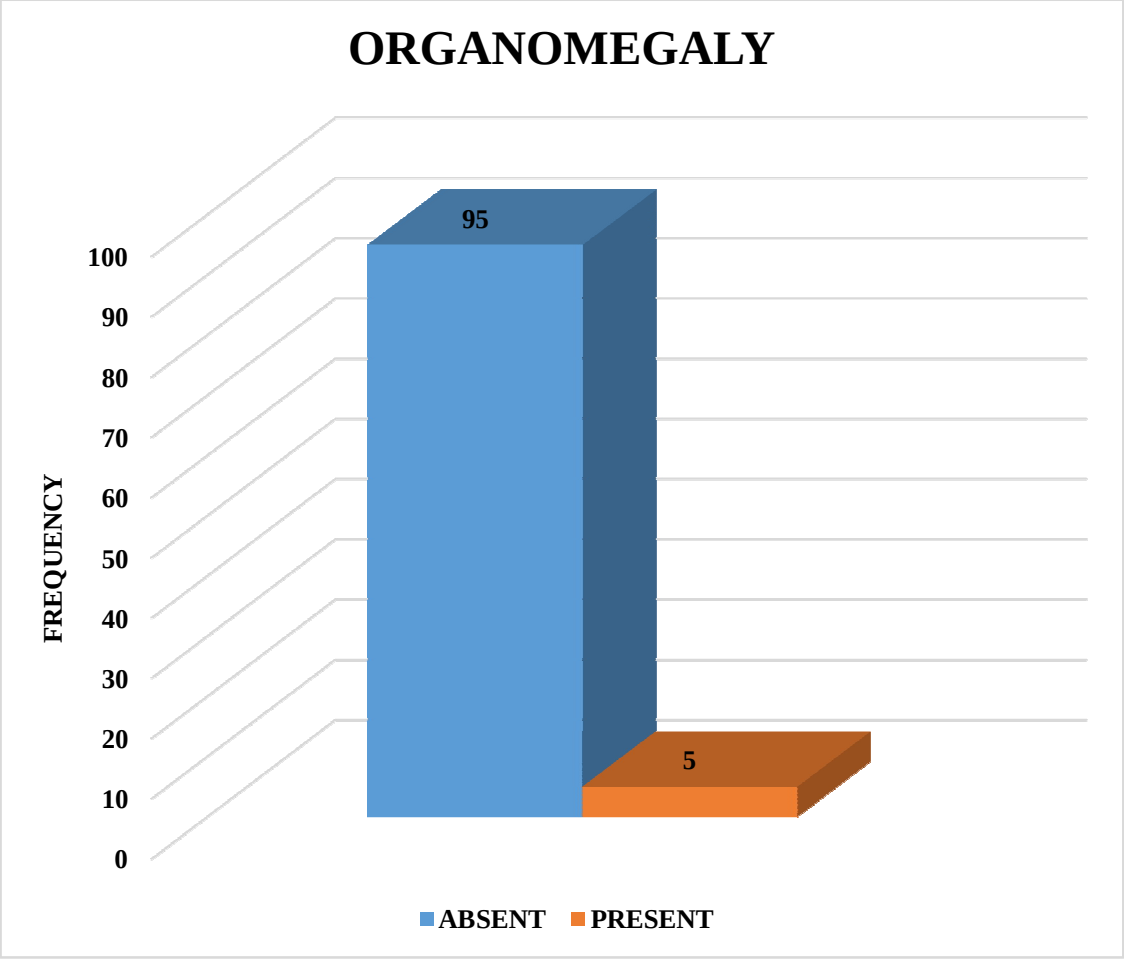
Table 5: Table for Fever




Fever was reported from 8 out of the 100 children included in the study.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Absent | 95 | 95.0 | 95.0 | 95.0 |
| | Present | 5 | 5.0 | 5.0 | 100.0 |
| | **Total** | **100** | **100.0** | **100.0** | |

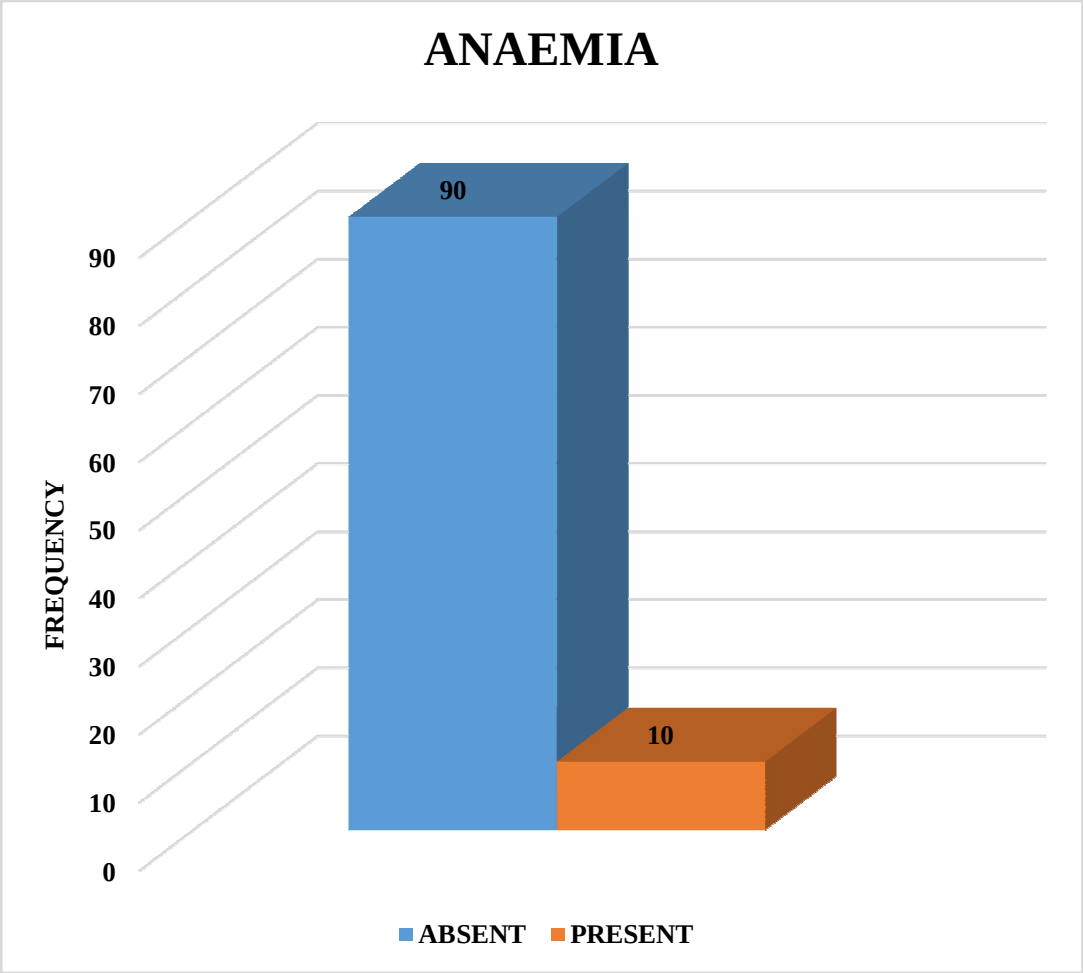
Table 6: Table for Organomegaly




Organomegaly was reported from 5 out of the 100 children included in the study.

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Absent | 90 | 90.0 | 90.0 | 90.0 |
| | Present | 10 | 10.0 | 10.0 | 100.0 |
| | **Total** | **100** | **100.0** | **100.0** | |

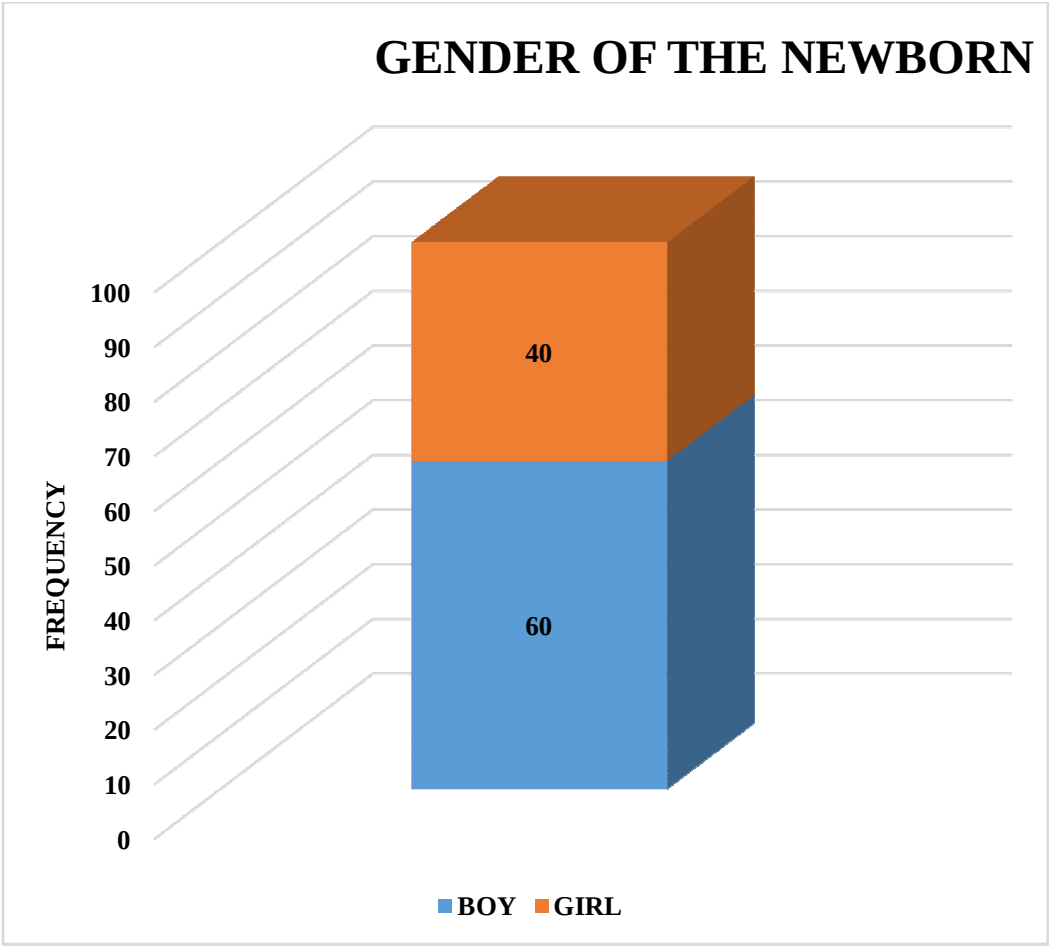
Table 7: Table for Anaemia




Anaemia was reported from 10 out of the 100 children included in the study

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| **Valid** | Boy | 60 | 60.0 | 60.0 | 60.0 |
| | Girl | 40 | 40.0 | 40.0 | 100.0 |
| | **Total** | **100** | **100.0** | **100.0** | |

Table 8: Table for Gender of New-borns




Out of the 100 babies delivered, 60 of the total were boy babies (60%) and the remaining 40 (40%) were girl babies.

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| **Maternal Age (in years)** | 100 | 18 | 35 | 24.88 | 3.851 |
| **Gestational Age (in weeks)** | 100 | 29 | 41 | 36.44 | 2.709 |
| **Birth Weight (in kg)** | 100 | .98 | 3.60 | 2.4867 | .60800 |
| **Valid N (list wise)** | 100 | | | | |

Table 9: Table for Maternal Age, Gestational Age and Birth Weight of the New-born

The maximum maternal age in years was 35 and minimum age was 18 years with a mean of 24.88 and a standard deviation of 3.851.

The lowest gestational age in weeks recorded was 29 and a highest of 41 weeks with a mean of 36.44 and standard deviation of 2.709.

Highest birth weight in Kg was 3.6 with a lowest of 0.98 kg. The mean was 2.4867 and a standard deviation of 0.608.

| Gender of the Baby | | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|---|
| **BOYS** | Maternal Age (in years) | 60 | 18 | 35 | 24.20 | 3.931 |
| | Gestational Age (in weeks) | 60 | 30 | 40 | 36.47 | 2.528 |
| | Birth Weight (in kg) | 60 | 1.10 | 3.40 | 2.4752 | .55721 |
| | Valid N (list wise) | 60 | | | | |
| **GIRLS** | Maternal Age (in years) | 40 | 20 | 34 | 25.90 | 3.536 |
| | Gestational Age (in weeks) | 40 | 29 | 41 | 36.40 | 2.994 |
| | Birth Weight (in kg) | 40 | .98 | 3.60 | 2.5040 | .68422 |
| | Valid N (list wise) | 40 | | | | |

Table 10: Table for Gender-wise Maternal Age,

Gestational Age and Birth Weight of the Newborn

Out of the 100 infants included in the study, 60 were males and the remaining 40 were females. The highest birth weight recorded among males was 3.4 kg with a lowest of 1.1 kg. The mean of birth weight in males was 2.475 with a standard deviation of 0.55721. The highest gestational age in weeks was 40 with a lowest of 30 weeks. The mean gestational age was 36.47 with a standard deviation of 2.528.

The highest birth weight recorded among females was 3.6 kg with a lowest of 0.98 kg. The mean of birth weight in males was 2.504 with a standard deviation of 0.684221. The highest gestational age in weeks was 40 with a lowest of 29 weeks. The mean gestational age was 36.40 with a standard deviation of 2.994.

Chi- squared test analysis was used to determine whether the difference between expected and observed results is significant i.e. whether any difference is caused by chance or if another factor is affecting the results. In this case we check differences in expected and observed count of Maternal Malaria and we check if the variables Gender, Jaundice, Fever, Organomegaly and Gravida are the factors affecting Maternal Malaria.

Here the Null hypothesis (H0) is: There is no significant statistical difference between the expected and observed results.

In the following pages are the cross tabulations between each of the variables and Maternal Malaria.

Table 11

## Gender * Malaria Crosstabulation

| | | | Maternal Malaria | | Total |
|---|---|---|---|---|---|
| | | | Absent | Present | |
| Gender | Boy | Count | 57 | 4 | 61 |
| | | Expected Count | 57.3 | 3.7 | 61.0 |
| | Girl | Count | 37 | 2 | 39 |
| | | Expected Count | 36.7 | 2.3 | 39.0 |
| Total | | Count | 94 | 6 | 100 |
| | | Expected Count | 94.0 | 6.0 | 100.0 |

## Chi-Square Tests

| | Value | Df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .086[a] | 1 | .769 | | |
| Continuity Correction[b] | .000 | 1 | 1.000 | | |
| Likelihood Ratio | .088 | 1 | .767 | | |
| Fisher's Exact Test | | | | 1.000 | .566 |
| N of Valid Cases[b] | 100 | | | | |

In the previous cross tabulation between gender and malaria (Table 11), it can be observed that there is no significant difference between observed and expected count.

Moving to the Chi- Square test table, 50% of the cells have expected count less than 5 which violates the Chi-square assumption, hence Pearson's Chi-Square statistic is invalid. So we look at the Likelihood Ratio where the p value is 1 which is much higher than level of significance which is 0.05 thus we accept the null hypothesis that Gender of the child is not a factor effecting Maternal Malaria.

Table 12

**JAUNDICE * Malaria Crosstabulation**

| | | | Maternal Malaria | | Total |
|---|---|---|---|---|---|
| | | | Absent | Present | |
| JAUNDICE | Absent | Count | 88 | 5 | 93 |
| | | Expected Count | 87.4 | 5.6 | 93.0 |
| | Present | Count | 6 | 1 | 7 |
| | | Expected Count | 6.6 | .4 | 7.0 |
| Total | | Count | 94 | 6 | 100 |
| | | Expected Count | 94.0 | 6.0 | 100.0 |

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .916[a] | 1 | .338 | | |
| Continuity Correction[b] | .017 | 1 | .895 | | |
| Likelihood Ratio | .694 | 1 | .405 | | |
| Fisher's Exact Test | | | | .361 | .361 |
| N of Valid Cases[b] | 100 | | | | |

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is .42.

b. Computed only for a 2x2 table

In the previous cross tabulation between Jaundice and Maternal Malaria (Table 12), it can be observed that there is no significant difference between observed and expected count.

Moving to the Chi- Square test table 25.0% of the cells have expected count less than 5 which violates the Chi-square assumption, hence Pearson's Chi-Square statistic is invalid. So we look at the Likelihood Ratio where the p value is 0.405 which is much higher than level of significance which is 0.05 thus we accept the null hypothesis that Jaundice is not a factor effecting Maternal Malaria.

Table 13

## FEVER * Malaria Cross tabulation

| | | | Malaria | | Total |
|---|---|---|---|---|---|
| | | | Absent | Present | |
| FEVER | Absent | Count | 87 | 5 | 92 |
| | | Expected Count | 86.5 | 5.5 | 92.0 |
| | Present | Count | 7 | 1 | 8 |
| | | Expected Count | 7.5 | .5 | 8.0 |
| Total | | Count | 94 | 6 | 100 |
| | | Expected Count | 94.0 | 6.0 | 100.0 |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .651[a] | 1 | .420 | | |
| Continuity Correction[b] | .001 | 1 | .975 | | |
| Likelihood Ratio | .518 | 1 | .471 | | |
| Fisher's Exact Test | | | | .402 | .402 |
| N of Valid Cases[b] | 100 | | | | |

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count

   is .48.

b. Computed only for a 2x2 table

In the previous cross tabulation between Fever and Maternal Malaria (Table 13), it can be observed that there is no significant difference between observed and expected count.

Moving to the Chi- Square test table 25.0% of the cells have expected count less than 5 which violates the Chi-square assumption, hence Pearson's Chi-Square statistic is invalid. So we look at the Likelihood Ratio where the p value is 0.471 which is much higher than level of significance which is 0.05 thus we accept the null hypothesis that Fever is not a factor effecting Maternal Malaria.

Table 14

## ORGANOMEGALY * Malaria Crosstabulation

| | | | Malaria | | Total |
|---|---|---|---|---|---|
| | | | Absent | Present | |
| ORGANOMEGALY | Absent | Count | 90 | 5 | 95 |
| | | Expected Count | 89.3 | 5.7 | 95.0 |
| | Present | Count | 4 | 1 | 5 |
| | | Expected Count | 4.7 | .3 | 5.0 |
| Total | | Count | 94 | 6 | 100 |
| | | Expected Count | 94.0 | 6.0 | 100.0 |

**Chi-Square Tests**

| | **Value** | **df** | **Asymp. Sig. (2-sided)** | **Exact Sig. (2-sided)** | **Exact Sig. (1-sided)** |
|---|---|---|---|---|---|
| Pearson Chi-Square | 1.829[a] | 1 | .176 | | |
| Continuity Correction[b] | .149 | 1 | .699 | | |
| Likelihood Ratio | 1.213 | 1 | .271 | | |
| Fisher's Exact Test | | | | .271 | .271 |
| N of Valid Cases[b] | 100 | | | | |
| a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .30. | | | | | |
| b. Computed only for a 2x2 table | | | | | |

In the previous cross tabulation between Organomegaly and Maternal Malaria (Table 14), it can be observed that there is no significant difference between observed and expected count.

Moving to the Chi- Square test table 50.0% of the cells have expected count less than 5 which violates the Chi-square assumption, hence Pearson's Chi-Square statistic is invalid. So we look at the Likelihood Ratio where the p value is 0.271 which is much higher than level of significance which is 0.05 thus we accept the null hypothesis that Organomegaly is not a factor effecting Maternal Malaria.

Table 15

**ANAEMIA * Malaria Cross tabulation**

| | | | Malaria | | Total |
|---|---|---|---|---|---|
| | | | **Absent** | **Present** | |
| ANAEMIA | Absent | Count | 84 | 6 | 90 |
| | | Expected Count | 84.6 | 5.4 | 90.0 |
| | Present | Count | 10 | 0 | 10 |
| | | Expected Count | 9.4 | .6 | 10.0 |
| Total | | Count | 94 | 6 | 100 |
| | | Expected Count | 94.0 | 6.0 | 100.0 |

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .709[a] | 1 | .400 | | |
| Continuity Correction[b] | .020 | 1 | .888 | | |
| Likelihood Ratio | 1.306 | 1 | .253 | | |
| Fisher's Exact Test | | | | 1.000 | .522 |
| N of Valid Cases[b] | 100 | | | | |

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is .60.

b. Computed only for a 2x2 table

In the previous cross tabulation between anaemia and maternal malaria (Table 15), it can be observed that there is no significant difference between observed and expected count.

Moving to the Chi- Square test table 25.0% of the cells have expected count less than 5 which violates the Chi-square assumption, hence Pearson's Chi-Square statistic is invalid. So we look at the Likelihood Ratio where the p value is 0.253 which is much higher than level of significance which is 0.05 thus we accept the null hypothesis that anaemia is not a factor effecting Maternal Malaria.

# DISCUSSION

The true incidence of congenital malaria remained a controversial issue for many years as many had reported it being an infrequent occurring. [9]

However, some studies conducted across Africa have brought to light that its occurrence was not so rare as was previously considered.

Pregnant women are more prone to malaria infection. [26]

As such maternal malaria has been known to have an adverse impact on the health of the newborn. [27]

Many studies have been conducted across the globe for reporting the incidence of cord blood parasitaemia in infants in malaria endemic zones.

Studies done across Africa have reported P. falciparum as the main causative agent. (WHO 2000)

In similar studies from India and a few Asian countries P. Vivax was the most common agent causing congenital malaria. (28)

Peripheral blood smears from placental, neonatal and cord blood have been used to look for malarial parasite.

The various studies done across have shown prevalence rates of 0 – 30%. (7)

In our study we have tried to study the prevalence of cord blood parasitaemia in infants in malaria endemic zone by examining the smears prepared from cord blood.

No case of congenital malaria could be detected using this technique during the entire study period.

A number of recent studies done across Africa reported congenital malaria as an infrequent occurring .The occurrence of cord or neonatal blood parasitaemia was found to be insignificant. Rare instances of few newborns developing the disease, during the initial weeks of life, have been shown.

The placenta has been shown to have a remarkable tendency and has been an effective barrier to restrict the passage of malarial parasite to the foetus.

The foetus too has a remarkable capacity to resist infection responsible for congenital malaria. (10)

A study was done in the hyper endemic region in the state of Madhya Pradesh. J. Singh et al had reported very low incidence of congenital malaria despite high prevalence of maternal malaria and emphasized on the need to conduct more studies in Indian setup. (7)

Similar study done in Central India by N.Singh et al reported higher prevalence of maternal malaria. (26)

The study did not report any prevalence of congenital malaria even though all symptomatic cases and those with maternal parasitaemia were followed up with repeat smears.

There were however many limitations in the study.

## LIMITATIONS OF THE STUDY

- The sample size of the study was small.
- It was conducted over a short period of time.
- Only peripheral smears prepared from cord blood were used to determine the presence of malarial parasites.
- The study did not incorporate other modalities like rapid diagnostic tests.
- Samples were neither drawn from all the babies (only the subsequently followed up ones) nor from the placenta for peripheral smear examination.
- The study registered only babies of mothers with history of fever.
- Also, the histopathological examination of the placenta, counted to be a further dependable technique of evaluating placental infection than considering only peripheral blood smears, was not done.

A number of factors have been reported to influence its estimation which include:

- difference in understanding the criteria for defining congenital malaria;
- resistance of mothers to infection;
- source from where the blood samples were taken for smear examination (neonatal or cord blood);
- the experience and reliability of peripheral smear examinations by the trained medical personnel;
- the technique used for parasite detection (Giemsa staining with smear examination or PCR). (12)

Failure to consider these factors could lead to its underestimation. Therefore, these influencing factors must be taken into consideration so as to avoid the false and inadequate estimation of its prevalence. (12)

A current Western Kenyan study discovered that by microscopy, the prevalence of placental infections was about seventeen percent and that of cord blood infections was zero percent, but by PCR technique, the prevalence was about thirty-three percent and almost eleven percent respectively. (29)

The findings prove that malaria diagnosis is commonly missed in newborns when microscopy is employed. The earlier estimate of prevalence of congenital malaria may have been under-reported owing to the inadequate sensitivity of light microscopy.

Repeat smear examination may be necessary to detect malarial parasitaemia.

Researchers in Turkey reported congenital malaria only after they were able to isolate the organism in repeat peripheral blood smears. (30)

A single blood smear in absence of parasitaemia is not sufficient to rule out malaria. (31)

Congenital malaria happened to get detected accidentally in a case in India showing no apparent symptoms. (32)

Due to shortage of precise symptoms, many cases of congenital malaria have been mistaken for sepsis or infections such as TORCH and syphilis (33).

A good clinical examination and follow-up, a high index of suspicion and a peripheral blood smear examination by an experienced personnel is essential for the accurate diagnosis of congenital malaria.

The detection of the parasite may require repeat peripheral blood smear examination.

Thereby, detection of plasmodial antigen or PCR of the blood may be employed in addition to enhance case detection rate. (29)

# CONCLUSION

The study was conducted at a tertiary centre in malaria endemic zone.

Infants with history of maternal fever were included in the study.

Peripheral smears were prepared from the cord blood to look for malaria parasite.

The study has reported a negative prevalence of congenital malaria.

The result of this study and previous other studies indicate a low prevalence of congenital malaria.

A total of six cases of maternal parasitaemia was found in the study. The cord blood parasitaemia could not be demonstrated in their infants (Pie Chart 1).

As demonstrated in Figure 10, few infants, however did show some symptoms despite a negative smear report.

A few of them presented with fever, anaemia, jaundice and organomegaly which was later evaluated for some other medical conditions.

A repeat peripheral smear was also done for them but it failed to demonstrate any parasite.

Anaemia was more common in preterms.

3 infants out of 6 with positive maternal malaria were of low birth weight.

Also the gestational ages were found to be less than 37 weeks in them.

However, the limitations of the study should also be taken into account.

Many studies done across have reported very less or no prevalence of cord blood parasitaemia.

Likewise, a recent study done in Kenya reported a no prevalence of cord blood parasitaemia when done using microscopy. A total of nearly 11% of cases were detected as positive when PCR was done in the same population.

The findings prove that malaria diagnosis is commonly missed in newborns when microscopy is employed. The former estimate of prevalence of congenital malaria may have been under-reported owing to the inadequate sensitivity of light microscopy.

Repeat smear examination may be necessary as a study done in Turkey was able to detect parasites only when the smears were repeated.

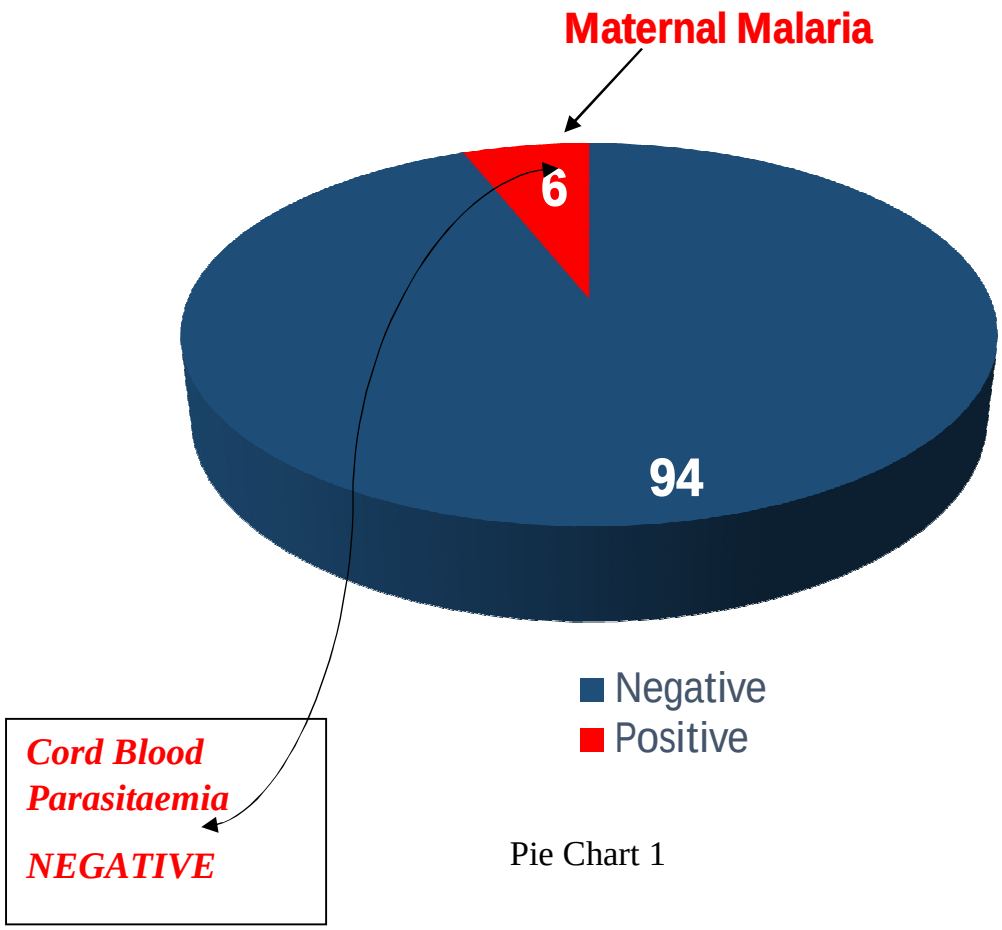
The study has reported no case of congenital malaria.

We conclude that cord blood parasitaemia estimation is not a very reliable method when used alone.

Diagnostic modalities such as PCR, histopathological examination of the placenta and other newer rapid diagnostic tests could also have been used in addition.

Therefore, there is a need to conduct more studies in the Indian setup using different modalities combined.

A total of 9 cases of maternal parasitaemia was found in the study out of the 100 maternal fever cases observed.




Pie Chart 1

However, the cord blood parasitaemia could not be demonstrated in their infants.

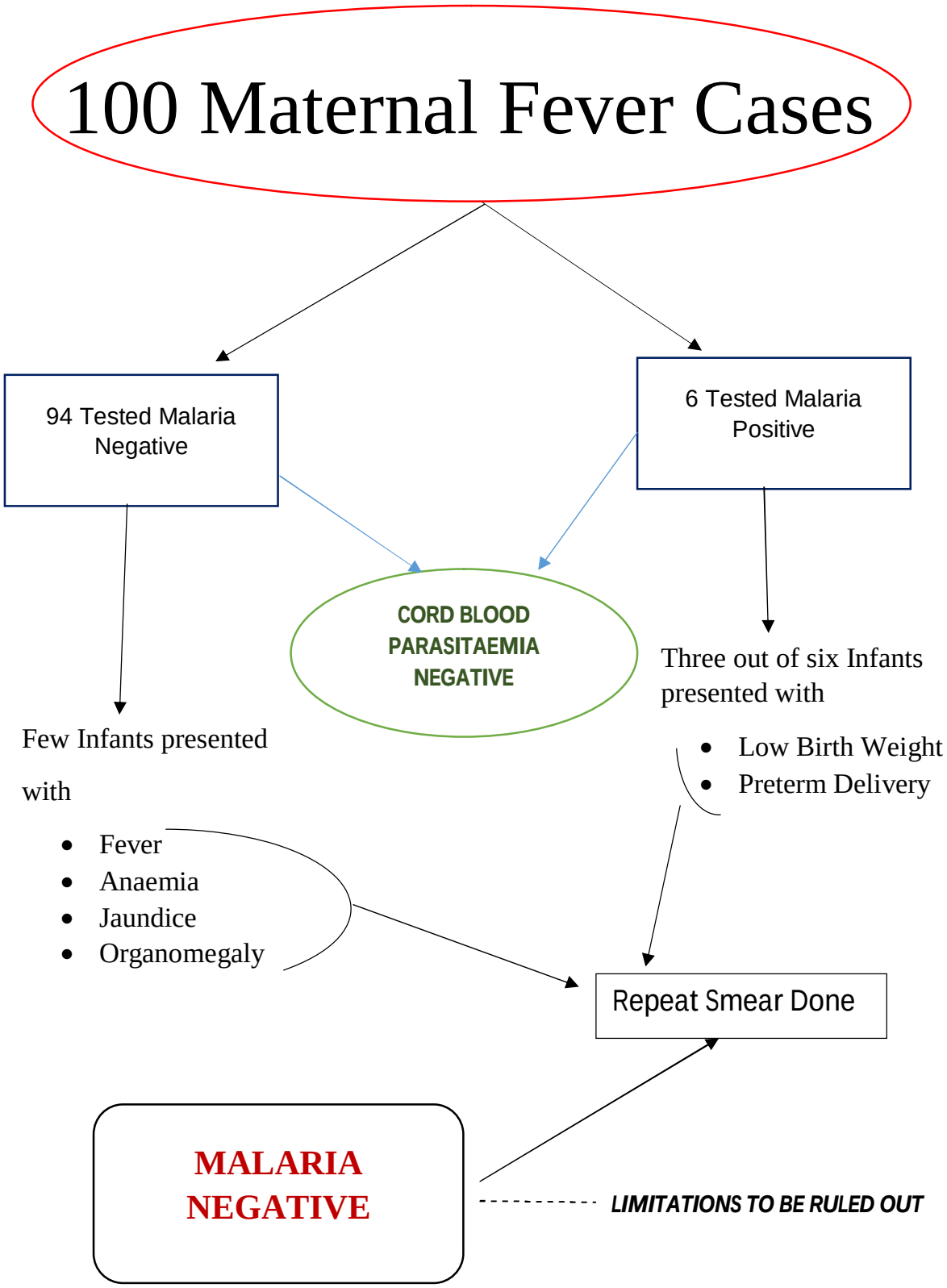

100 Maternal Fever Cases
94 Tested Malaria Negative
6 Tested Malaria Positive
CORD BLOOD PARASITAEMIA NEGATIVE
Few Infants presented with
Fever
Anaemia
Jaundice
Organomegaly
Three out of six Infants presented with
Low Birth Weight
Preterm Delivery
Repeat Smear Done
MALARIA NEGATIVE
LIMITATIONS TO BE RULED OUT

Figure 10

# SUMMARY

- Various studies have concluded that congenital malaria is not as infrequent as was formerly speculated.

- A close connection between placental parasitaemia and cord blood parasitaemia is accountable for congenital malaria.

- The study did not detect any cord blood parasitaemia.

- Many studies done across have reported very less or no prevalence of cord blood parasitaemia despite high maternal parasitaemia.

- A zero percent prevalence of cord-blood parasitaemia was reported in a study when done using microscopy. PCR detected nearly eleven percent cases positive in the same population.

- Repeat smear examination may be necessary to detect parasitaemia.

- Diagnostic modalities such as PCR, histopathological examination of the placenta and newer rapid diagnostic tests could also have been used in addition.

- Therefore, there is a need to conduct more studies in the Indian setup using different modalities combined.

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# ABBREVIATIONS

| | |
|---|---|
| **PCR** | Polymerase chain reaction |
| **Hb** | Haemoglobin |
| **HPE** | Histopathological examination |
| **WHO** | World Health Organization |
| **CS PROTIEN** | Circumsporozoite protien |
| **HIV** | Human immunodeficiency virus |
| **RDT** | Rapid diagnostic test |
| **EDTA** | Ethylene Diamine TetraAcetic acid |
| **WBC** | White blood cells |
| **LBW** | Low birth weights |
| **AIDS** | Acquired immunodeficiency syndrome |
| **RBC** | Red Blood Cells |

# INSTITUTIONAL ETHICS COMMITTEE
# MADRAS MEDICAL COLLEGE, CHENNAI 600 003

EC Reg.No.ECR/270/Inst./TN/2013
Telephone No.044 25305301
Fax: 011 25363970

## CERTIFICATE OF APPROVAL

To

Dr.CHEWANG DORJEE BHUTIA
Post Graduate MD (Paediatricts)
Institute of Child Health
Chennai 600 008.
Madras Medical College
Chennai 600 003

DEAR DR. CHEWANG DORJEE BHUTIA

The Institutional Ethics Committee has considered your request and approved your study titled **"PREVALANCE OF CORD BLOOD PARASITAEMIA & ITS IMPCACT IN HEALTH OF NEWBORNS"** NO.13032015.

The following members of Ethics Committee were present in the meeting hold on 03.03.2015 conducted at Madras Medical College, Chennai 3

| | |
|---|---|
| 1. Prof.C.Rajendran, MD | :Chairperson |
| 2. Prof.R.Vimala,MD.,Dean,MMC,Ch-3 Chairperson | : Deputy |
| 3. Prof.B.Kalaiselvi,MD.,Vice Principal,MMC,Ch-3 Secretary | : Member |
| 4. Prof.R.Nandini,MD.,Inst.of Pharmacology,MMC | : Member |
| 5. Prof.K.Ramadevi, Director I/c,Inst.of Bio-Chem.MMC | : Member |
| 6. Prof.Saraswathy,MD.,Director,Pathology, MMC | : Member |
| 7. Prof.S.G.Sivachidambaram,MD.,Director I/c Inst.of Internal Medicine,MMC | : Member |
| 8. Thiru S.Rameshkumar, B.Com., MBA. | : Lay Person |
| 9. Thiru S.Govindasamy, BA., BL., | : Lawyer |
| 10.Tmt.Arnold Saulina, MA., MSW., | : Social Scientist |

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary – Ethics Committee

**INFORMATION SHEET**

Place of study: INSTITUTE OF CHILD HEALTH AND HOSPITAL FOR CHILDREN / INSTITUTE OF GYNAECOLOGY, EGMORE,CHENNAI-8.

Name of Investigator :**Dr.CHEWANG DORJEE BHUTIA**

Name of Participant age: sex:

Hospital No:

Study title:"Prevalance of cord blood parasitaemia & its impact in the health of newborns" Cord blood samples will be collected at the time of delivery.

Blood smears will be prepared& examined for presence of malarial parasites.

Newborns of smear positive cases will be assessed & followed up.

No blood samples will be drawn. They will be clinically examined for organomely, fever ,jaundice , anaemia, weight monitored & nutritional status assessed.

The privacy of the patients in the research will be maintained throughout the study. Inthe event of any publication or presentation resulting from the research, no personallyidentifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate inthis study or to withdraw at any time; your decision will not result in any loss ofbenefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study periodor during the study if anything is found abnormal which may aid in the managementor treatment.

Signature of investigator. Signature of parent/guardian.

Date:

# INFORMED CONSENT FORM

Study place: INSTITUTE OF CHILD HEALTH AND HOSPITAL FOR CHILDREN /

INSTITUTE of GYNAECOLOGY, EGMORE,CHENNAI-8.

Title of the study :"PREVALANCE OF CORD BLOOD PARASITAEMIA & ITS IMPACT

IN THE HEALTH OF NEWBORN."

Name of the investigator**:Dr. CHEWANG DORJEE BHUTIA**

Name of the Participant: Age: Sex:

Hospital number:

1. I have read and understood this consent form and the information provided to me regarding the participation of my child in the study.
2. I have had the consent document explained to me.
3. I have been explained about the nature of the study.
4. I have been explained about my rights and responsibilities by the investigator.
5. I will allow my child to undergo clinical tests subjected during the study whole heartedly.
6. I will allow my child to cooperate with the investigator through out the study.
7. I have been advised about the risks associated with my child's participation in this study.*
8. I agree that my child will cooperate with the investigator and I will inform him/her immediately if my child suffer from some problem during the study. *
9. My childhave not participated in any research study in the past.
10. I am aware of the fact that I can opt out of the study at any time without having to give any reason and this will not affect my child's future treatment in this hospital. *
11. I am also aware that the investigator may terminate mychild's participation in the study at any time, for any reason, without my consent. *
12. I hereby give permission to the investigators to release the information obtained from my child as result of participation in this study to the sponsors, regulatory authorities, Govt. agencies, and IEC. I understand that they are publicly presented.
13. I have understand that my child's identity will be kept confidential if my child's data are publicly presented
14. I have had my questions answered to my satisfaction.

15. I have decided my child can beparticipated in the research study.

I am aware that if I have any question during this study, I should contact the investigator. By signing this consent form I attest that the information given in this document has been clearly explained to me and understood by me, I will be given a copy of this consent document.

Name and signature / thumb impression of the parents/guardian

Name _____ Signature_____

Date_____

Name and Signature of impartial witness:

Name _____ Signature_____

Date_____

Name and Signature of the investigator or his representative obtaining consent:

Name _____ Signature_____

Date_____

தகவல் படிவம்

ஆய்விடம் : அரசு குழந்தைகள் நல மருத்துவமனை மற்றும் ஆராய்ச்சி நிலையம் மற்றும் ஆராய்ச்சி நிலையம் மற்றும் மகப்பேறு மருத்துவமனை.

ஆய்வாளர் : சுவாங் டார்ஜி பூட்டியா

பங்கு பெறுபவரின் பெயர்- வயது

மருத்துவமனையின் எண் பாலினம்

ஆய்வு தலைப்பு : பச்சிளங்குழந்தையின் தொப்புள் கொடி இரத்தத்தில் மலேரியா ஒட்டுண்ணி இருப்பதை கண்டறிதல் மற்றும் அதன் விளைவுகள் பற்றி ஆராய்தல்.

1) தங்கள் குழந்தையையும் இந்த ஆய்வில் பங்குபெற கேட்டுக் கொள்கின்றோம்.
2) பிரசவத்தின் பொழுது தொப்புள் கொடியின் இரத்தம் சேகரிக்கப்படும்.
3) இரத்த ஸ்மியர்கள் தயாரிக்கப்பட்டு மலேரியா ஒட்டுண்ணி இருக்கின்றனவா என்று பரிசோதிக்கப்படும்.
4) இரத்த ஸ்மியர்களில் மலேரியா ஒட்டுண்ணி இருந்தால் அந்த பச்சிளங்குழந்தைகள் கண்காணிக்கப்படும்.
5) பச்சிளங் குழந்தைகளிடமிருந்து இரத்தம் எடுக்கப்படமாட்டாது.
6) காய்ச்சல், காமாலை இரத்த சோகை, கல்லீரல், மண்ணீரல் வீக்கம், எடை மற்றும் வளர்ச்சி ஆகியவை கண்காணிக்கப்படும்.
7) உங்கள் குழந்தையைப் பற்றிய தனிப்பட்ட விவரங்கள் யாருக்கும் தெரிவிக்காமல் பாதுகாக்கப்படும்.
8) இந்த ஆய்வில் பங்கு பெறுவது உங்கள் தனிப்பட்ட விருப்பமே. ஆய்வு ஆரம்பித்தபின் விருப்பம் இல்லை என்றால் தாங்கள் விலகிக் கொள்ளலாம். அவ்வாறு விலகுவதானது தங்கள் குழந்தையின் சிகிச்சைக்கு எவ்வித பாதிப்பையும் உருவாக்காது.
9) ஆய்வின் முடிவுகள் ஆய்வு நடக்கும் போதோ (தேவை ஏற்படின்) அல்லது ஆய்வு முடித்த பின்னரோ தங்களுக்கு தெரிவிக்கப்படும். அந்த முடிவுகள் தங்கள் குழந்தையின் சிகிச்சைக்கு பேருதவியாக இருக்கக்கூடும்.

ஆய்வாளரின் கையொப்பம் பெற்றோரின் கையொப்பம்

நாள் :

இடம் :

## ஒப்புதல் படிவம்

1. இந்த ஆய்வைப் பற்றிய அனைத்து தகவல்களும் எனக்கு தெரிவிக்கப்பட்டது.

2. இதில் பங்கு பெறுவதற்கான ஒப்பந்த படிவமும் எனக்கு விவரிக்கப்பட்டது.

3. ஆராய்ச்சியின் தன்மையும், எனது உரிமைகளும் எடுத்துரைக்கப்பட்டது.

4. இந்த ஆய்வினால் எனது குழந்தையின் நலனுக்கு எந்த தீங்கும் இல்லை என்பதை தெரிந்து கொண்டேன்.

5. இந்த ஆய்வில் எனது குழந்தை பங்கு பெற எனது மனமார்ந்த ஒப்புதலை தருகிறேன்.

பெற்றோரின் கையொப்பம் சாட்சியின் கையொப்பம்

ஆய்வாளரின் கையொப்பம்

தேதி

இடம்

# Data collection sheet

Name : Maternal age :

Maternal fever :

Gravida :

Ip no :

Address :

Maternal malaria : Yes/No

CORD BLOOD FOR MALARIAL PARASITE : Positive /Negative

## Newborn

| | | |
|---|---|---|
| Birth Weight | : | (in kg ) |
| Sex of the child | : | Boy/girl |
| Gestational age | : | (in weeks) |

## Symptoms in newwborns

| | | |
|---|---|---|
| Organomegaly | : | Yes/No |
| Jaundice | : | Yes/No |
| Anaemia | : | Yes/No |
| Fever | : | Yes/No |

Repeat peripheral smear examination (done for symptomatic cases) :

Positive / Negetive

| NAME | MATENAL AGE (in yrs) | MATERNAL FEVER | GRAVIDA | CORD BLOOD PARASITAEMIA | MATERNAL MALARIA | GESTATION( in weeks) | BIRTH WEIGHT(in kg) | JAUNDICE | FEVER | ORGANOMEGALY | ANAEMIA | GENDER | INFANTS FOLLOWED UP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B/o Saranya | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.7 | absent | present | absent | absent | boy | YES |
| B/o Indumathy | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.84 | absent | absent | absent | present | boy | YES |
| B/o Khushboo | 20 | yes | PRIMI | NEGATIVE | POSITIVE | 35 | 2.1 | absent | absent | absent | absent | boy | YES |
| B/o Thilagavathy | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 39 | 3.1 | absent | absent | absent | absent | girl | NO |
| B/o Jeevalakshmi | 30 | yes | G3P2L1 | NEGATIVE | NEGATIVE | 36 | 2.4 | absent | absent | absent | absent | girl | NO |
| B/o Ranjitha | 25 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 33 | 1.9 | absent | absent | absent | present | girl | YES |
| B/o Vijaya | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.75 | absent | absent | absent | absent | boy | NO |
| B/o Vinodhini | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 39 | 2.6 | absent | absent | absent | absent | boy | NO |
| B/o Marthammal | 32 | yes | G3P2L2 | NEGATIVE | POSITIVE | 32 | 1.4 | absent | absent | absent | absent | girl | YES |
| B/o Jayalitha | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 34 | 1.98 | absent | present | absent | absent | boy | YES |
| B/o Karpagan | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.4 | absent | absent | absent | absent | girl | NO |
| B/o Abirami | 26 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.9 | absent | absent | absent | absent | boy | NO |
| B/o Kowshika Devi | 27 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3.1 | absent | absent | absent | present | girl | YES |
| B/o Nagavalli | 19 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.45 | absent | absent | absent | absent | boy | NO |
| B/o Nancy | 28 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 30 | 1.2 | absent | absent | absent | present | girl | YES |
| B/o Sarala | 34 | yes | G4P3L2 | NEGATIVE | NEGATIVE | 38 | 2.56 | absent | absent | absent | absent | girl | NO |
| B/o Chinishyala | 32 | yes | G4P3L2 | NEGATIVE | NEGATIVE | 39 | 2.8 | absent | absent | absent | absent | boy | NO |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B/o Malar | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.52 | absent | present | present | absent | boy | YES |
| B/o Abina Begum | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.3 | absent | present | absent | absent | boy | YES |
| B/o Anitha | 27 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 33 | 1.7 | present | absent | absent | absent | girl | YES |
| B/o Lavanya | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 31 | 1.3 | absent | absent | absent | absent | boy | NO |
| B/o Thanagamani | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.7 | absent | absent | absent | absent | boy | NO |
| B/o Parameshwari | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 33 | 1.6 | present | absent | present | absent | boy | YES |
| B/o Swathi | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.68 | absent | absent | absent | absent | boy | NO |
| B/o Gowthami | 24 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 37 | 3.2 | absent | absent | absent | absent | boy | NO |
| B/o Mahalakshmi | 26 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 37 | 3.1 | absent | absent | absent | absent | boy | NO |
| B/o Brinda | 28 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 36 | 3 | absent | absent | absent | absent | boy | NO |
| B/o Jayashree | 29 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 37 | 2.2 | absent | absent | absent | absent | boy | NO |
| B/o Sathya | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3.4 | absent | absent | absent | absent | boy | NO |
| B/o Mahalakshmi | 26 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 3.2 | absent | absent | absent | absent | girl | NO |
| B/o Kanaga Durga | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.8 | absent | absent | absent | absent | boy | NO |
| B/o Bharathi | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.45 | absent | absent | absent | absent | boy | NO |
| B/o Amalavathy | 25 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 34 | 2.5 | absent | absent | absent | absent | boy | NO |
| B/o Revathy | 25 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 35 | 2.15 | present | absent | absent | absent | girl | YES |
| B/o Nathiya | 28 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 37 | 2.54 | absent | absent | absent | absent | boy | NO |
| B/o Gowri | 35 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 39 | 2.7 | absent | present | absent | absent | boy | YES |
| B/o Arulmozhi | 30 | yes | PRIMI | NEGATIVE | NEGATIVE | 39 | 2.9 | absent | absent | absent | absent | girl | NO |
| B/o Shanthi | 30 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 35 | 2.25 | absent | absent | absent | absent | boy | NO |
| B/o Bakiyalakshmi | 23 | yes | PRIMI | NEGATIVE | POSITIVE | 38 | 2.7 | absent | absent | absent | absent | boy | YES |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B/o Rajeshwari | 34 | yes | G4P3L1 | NEGATIVE | POSITIVE | 35 | 2.1 | absent | absent | absent | absent | boy | YES |
| B/o Nazra Begum | 24 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.98 | absent | absent | absent | absent | girl | NO |
| B/o Christina Mary | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 3 | absent | absent | absent | absent | girl | NO |
| B/o Hemalatha | 22 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 32 | 1.4 | absent | absent | absent | present | boy | YES |
| B/o Chitra Devi | 32 | yes | G3P1L1A1 | NEGATIVE | NEGATIVE | 32 | 1.35 | absent | absent | absent | present | girl | YES |
| B/o Kumari | 25 | yes | G2PILI | NEGATIVE | NEGATIVE | 37 | 2.3 | absent | absent | absent | absent | boy | NO |
| B/o Devi | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.4 | absent | absent | absent | absent | boy | NO |
| B/o Umashankari | 25 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 37 | 2.45 | absent | absent | absent | absent | girl | NO |
| B/o Jayanthi | 24 | yes | PRIMI | NEGATIVE | NEGATIVE | 31 | 1.2 | absent | present | absent | absent | boy | YES |
| B/o Saranya | 27 | yes | G3P2L1 | NEGATIVE | NEGATIVE | 30 | 1.1 | absent | absent | absent | absent | boy | NO |
| B/o Hemapriya | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 29 | 0.98 | absent | absent | absent | absent | girl | NO |
| B/o Punitha | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 3.3 | absent | absent | absent | absent | boy | NO |
| B/o Rajakumari | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 3.1 | absent | absent | absent | absent | boy | NO |
| B/o Subhashini | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 35 | 2.2 | present | absent | present | absent | girl | YES |
| B/o Geetha | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.4 | absent | absent | absent | absent | boy | NO |
| B/o Vijayasri | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.7 | absent | absent | absent | absent | boy | NO |
| B/o Gomathy | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 34 | 2.1 | absent | absent | absent | absent | girl | NO |
| B/o Payal | 18 | yes | PRIMI | NEGATIVE | POSITIVE | 37 | 2.5 | absent | absent | absent | absent | boy | YES |
| B/o Rajeshwari | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 3.1 | absent | absent | absent | absent | girl | NO |
| B/o Vidhya | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.4 | absent | absent | absent | absent | boy | NO |
| B/o Megha | 29 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 37 | 2.45 | absent | absent | absent | absent | boy | NO |
| B/o Meera | 25 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3.4 | absent | absent | absent | absent | girl | NO |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B/o Menuka | 24 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3.1 | absent | absent | absent | absent | girl | NO |
| B/o Gowthami | 27 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 3 | absent | absent | absent | absent | girl | NO |
| B/o Gowri | 28 | yes | G3P2L1 | NEGATIVE | NEGATIVE | 39 | 3.6 | absent | absent | absent | absent | girl | NO |
| B/o Saraswati | 22 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.89 | absent | absent | absent | absent | girl | NO |
| B/o Chitra | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 39 | 2.68 | absent | absent | absent | absent | boy | NO |
| B/o Rani | 27 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.45 | absent | absent | absent | absent | boy | NO |
| B/o Bhuvaneshwari | 26 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3 | absent | absent | absent | absent | boy | NO |
| B/o Arulmozhi | 29 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 40 | 3.2 | absent | absent | absent | absent | girl | NO |
| B/o Kavitha | 28 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 30 | 1.3 | absent | absent | absent | absent | girl | NO |
| B/o Deepa | 22 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.7 | absent | absent | absent | absent | boy | NO |
| B/o Yazhimozhi | 30 | yes | G3P1L1A1 | NEGATIVE | NEGATIVE | 37 | 2.4 | absent | absent | absent | absent | girl | NO |
| B/o Jenith | 28 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3.2 | absent | absent | absent | absent | girl | NO |
| B/o Ajitha | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.39 | absent | absent | absent | absent | boy | NO |
| B/o Narmada | 26 | yes | PRIMI | NEGATIVE | NEGATIVE | 35 | 2.6 | absent | absent | absent | absent | boy | NO |
| B/o Lakshmi | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 3 | absent | absent | absent | absent | girl | NO |
| B/o Pooja | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.5 | absent | absent | absent | absent | boy | NO |
| B/o Srija | 19 | yes | PRIMI | NEGATIVE | NEGATIVE | 34 | 2.4 | absent | absent | absent | absent | boy | NO |
| B/o Jayanthy | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.3 | absent | absent | absent | absent | boy | NO |
| B/o Abirami | 28 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 37 | 2.45 | absent | absent | absent | absent | girl | NO |
| B/o Abinaya | 27 | yes | G3P2L2 | NEGATIVE | NEGATIVE | 34 | 2.2 | absent | absent | absent | absent | girl | NO |
| B/o Menuga | 31 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 40 | 3.3 | absent | absent | absent | absent | boy | NO |
| B/o Jenny | 30 | yes | G3P1L1A1 | NEGATIVE | NEGATIVE | 40 | 3.1 | absent | absent | absent | absent | boy | NO |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B/o Damyanthy | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.2 | absent | absent | absent | absent | girl | NO |
| B/o Dhaarani | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.48 | absent | absent | absent | absent | boy | NO |
| B/o Sujitha | 30 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 41 | 3.1 | absent | absent | absent | absent | girl | NO |
| B/o Suganya | 26 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.8 | absent | absent | absent | absent | girl | NO |
| B/o Ranjita | 23 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 37 | 2.4 | present | absent | absent | present | boy | YES |
| B/o Tasleem Begum | 29 | yes | G3P2L2 | NEGATIVE | POSITIVE | 37 | 2.5 | absent | absent | absent | absent | boy | YES |
| B/o Yaalani | 32 | yes | G3P1L1A1 | NEGATIVE | NEGATIVE | 30 | 1.2 | absent | absent | absent | absent | boy | NO |
| B/o Kavya | 27 | yes | PRIMI | NEGATIVE | NEGATIVE | 33 | 1.5 | present | absent | present | present | girl | YES |
| B/o Rekhashree | 23 | yes | PRIMI | NEGATIVE | NEGATIVE | 32 | 1.45 | absent | absent | absent | present | boy | YES |
| B/o Jeevashree | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 36 | 2.2 | absent | present | absent | absent | girl | YES |
| B/o Sree Devi | 29 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 38 | 2.5 | absent | absent | absent | absent | boy | NO |
| B/o Hema | 20 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 2.35 | absent | absent | absent | absent | girl | NO |
| B/o Christine | 27 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 39 | 3 | absent | absent | absent | absent | girl | NO |
| B/o Sajeeta Begum | 21 | yes | PRIMI | NEGATIVE | NEGATIVE | 37 | 3.4 | absent | absent | absent | absent | boy | NO |
| B/o Jenifer | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 39 | 2.75 | absent | absent | absent | absent | boy | NO |
| B/o Poornika | 22 | yes | PRIMI | NEGATIVE | NEGATIVE | 38 | 2.8 | absent | present | absent | absent | boy | YES |
| B/0 Pongodi | 27 | yes | G2P1L1 | NEGATIVE | NEGATIVE | 36 | 2.4 | present | absent | present | present | girl | YES |